The Treatment of Sediment-Carrying Mountain Streams in Europe and its Application to California.*

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Introductory Remarks.—The debris question, so important to the interests of this State, is full of interesting features. It is of such intricate and complicate nature, that only the most careful and impartial investigations of all the conditions bearing upon it can bring about its successful solution. The desire to contribute a small share to such, has moved the writer to investigate what has been done in reference to sediment-carrying rivers, torrential streams, etc., in other parts of the world. The Alps in the southern and central part of Europe afford the best opportunity to study this question as they have a great many such water-courses, which have damaged and partially continue to destroy the valleys by raising the river bed and destroying adjoining agricultural lands by erosion or filling in. Certain portions of these, however, have been very successfully improved by comparatively simple and inexpensive means. The source of the detritus there is natural wash, and in no case hydraulic mining.

In California the conditions are somewhat different, since the natural as well as the artificial source of the detritus must be considered. Appreciating fully this difference, it is nevertheless apparent that a study of the works of European engineers, in reference to the permanent improvement of sediment carrying water-courses, cannot fail to be of service to those engaged in the solution of this question in California. Taking advantage of this experience and modifying their measures according to local conditions, more satisfactory results will be obtained than if the same were ignored. No originality is claimed for that part of this paper, still the writer hopes it will be agreeable to the members of the Technical Society and will give rise to a thorough and careful discussion and investigation on the part of this society, of one of the most important questions in California.

Characteristics of Torrential Streams.—Before entering upon an account of the remedies applied, it is necessary to look into the general nature of torrential streams.

1. *Origin.* The constant influence of the atmosphere, the rains, snows, hail and dews, and the changes of temperature, all affect the materials of which the mountains are composed, and cause a continuous disintegration of their surfaces, which are washed down subsequently by the falling rain. This occurs most rapidly there where the soil is not protected by vegetation. The flowing water cuts a channel in which the detritus is carried to the lower valleys. The disintegration and erosion progresses then more rapidly. The water undermines the slopes, these losing their equilibrium, slide into the water-course and are carried away by the water. The bed becomes wider and deeper, new tributaries are formed until a large number of them cover the whole water-shed.

2. *Classification.*—The torrential streams can be classified conveniently as follows:

a. Simple Torrential Streams, having but one main gorge or valley into which a smaller or greater number of secondary tributaries issue.

b. Compound Torrential Streams, which have two or more main gorges or valleys, or are composed of several simple torrential streams.

c. Fan-shaped Erosions on the slope of the mountains. Here one deep erosion is fed by a large number of smaller ones, they are generally dry, except during the rainy season.

3. *Subdivisions.*—To whatever class the torrents belong, they all show three or four distinct subdivisions:

a. *Region of Erosion*—Collecting basin. A, B, C, in Fig. 1. This comprises the upper part of the water-shed, where the water and the products of disintegration and decomposition are collected, and from which, both combined, are carried into b, *region of transportation* (a b in Fig. 1), which serves as channel-way to transport the water and the detritus into the c, *region of deposition* (b c in Fig. 1), which is raised continuously by the settling of detritus, d, *channel of discharge* (c d in Fig. 1,) carries the water from the region of deposition where it left its coarser detritus, to the main river. This section, however, is sometimes missing. All these subdivisions can occur several times in one and the same water-course.

4. *Action of the Water in Torrential Streams.*—During the dry season most of these streams are harmless. As soon, however, as warm

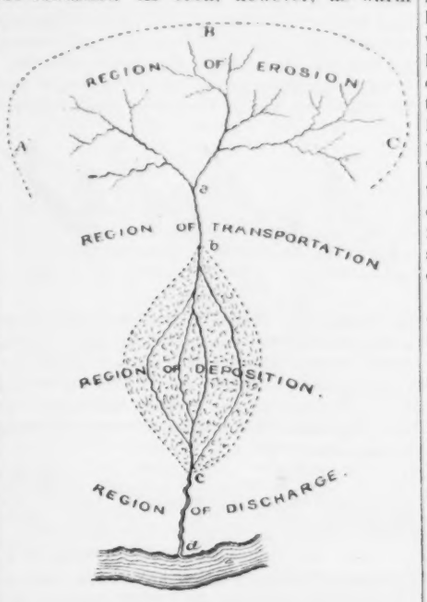

FIG. 1.

winds cause a sudden melting of the snow, cloud-bursts occur or a long-lasting rain sets in, the erosion becomes immense. A chaotic mass of debris, gravel, rocks and bowlders, is carried down by the water to the valley. The volume of the sediment is sometimes several times larger than that of the water. In the beginning all the different classes of detritus are carried along with the same velocity. Soon, however, the large detritus will attain a greater velocity on account of its volume, and will deposit itself wherever a sudden decrease of the grade occurs. The other material will lodge behind them at first in a general disorder, but later on in the order of their respective dimensions. The region of deposit will then assume a *convex* profile. If then the volume and the power of the water should become greater, a reversed action commences, *i. e.* that of the separation of different sized detritus. The water carries now each kind of detritus separately with a velocity inversely proportional to its size. The result is that the fine material will be deposited at the lower edge of the region of deposit and the coarser at or near the apex of the same. The longitudinal profile of this region will then assume a *concave* form, *i. e.* it will be steeper towards the source. This change from a convex to a concave profile will occur after each large rain-storm or melting of snow. The convex profile proves that the stream has just come to a comparative rest. In this way the region of deposit will always be replenished, its grade will constantly increase, until finally all the material carried to it by the stream loses its equilibrium and is carried farther down the valley. The grade on which this will occur, is called the "*profile of equalization.*" Then only such masses of detritus are transported from the upper region, as the region of transportation can carry away. This corresponds to a continuous transportation of detritus in both regions, necessitating a cessation of the above mentioned increase in the grade of the region of deposit.

But this state is not a permanent one, for as soon as the water becomes clearer and enters the region of deposit without being charged with detritus, then a similar process of erosion and transportation will take place, by which the surface of the region of deposit will be lowered more and more, and its slope will become gentler. This will continue as long as the grade is steep enough for the water to carry off the detritus. When, however, the limit of this is reached, and the transporting power of the water and the resistance of the river-bed balance each other, then the stream has "worked out" or becomes dormant; it will discharge only clear water, and the stream has adopted its final profile, the "*profile of equilibrium.*" The profile of the region of transportation is always a concave curve at its lower end. It may, however, have a profile which does not fit into such continuous curve. This is the case when the erosion has reached the bed-rock at several points. Then smaller or larger falls are formed, which interrupt the regularity of the profile. Below and above such places, the regular concave profile will exist.

Means of Improving Mountain Streams.—In order to improve torrential streams in a permanent manner, it is necessary to determine:

1. How the formation of detrius can be prevented, or at least be decreased?

2. How the detritus can be stored near its sources?

The leading principle of any improvement is to attack the evil at its very source. Small slides and erosions, in their first state of formation, can be stopped easily at little cost, but if allowed to attain larger dimensions, they become rapidly more powerful, and require much more extensive and costly works.

The improvements requisite are—

1. Such as will prevent the sudden and rapid collection of larger quantities of rain water. This is accomplished by the planting of forests and the raising of grass and underbrush near the sources of the water-courses. Vegetation protects the soil against the mechanical effects of the rain; the roots bind the soil together, and the fallen leaves and the grasses retard the flow of the rain water; the plants absorb the same and store it for a continuous and regular supply of the springs and water-courses. This will prevent the sudden rises of the rivers.

2. The protection of the shores against undermining, and the bed against erosion. This is principally done by the erection of "Thalsperren." The German word for these structures has been retained, as it is more significant and comprehensive than the English expression "restraining wall." It includes works which are not walls, but have the same duty, but in a less degree.*

A Thalsperre is a structure erected across the bed of a stream, to diminish the grade of the same, and to decrease the power of the water; also to raise and thereby widen the bed; and to retain or store detritus. A distinction is made between "*dead and live thalsperren.*" The first are built of rock or timber, and the latter of hurdlework and fascines, made of green branches. The latter have that advantage over the former, that their resisting power will increase from year to year, as the branches drive their roots into the river-bottom, and the growing twigs oppose greater obstacles to the water. The thalsperren of rock are either curved or straight. They can be built of dry masonry, or of masonry in mortar, or both. Wooden thalsperren should

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*The definition of the word "Thalsperre" is, a structure which closes up a valley. "Thal" is the German word for valley, and "sperren" to "close up."

be used only where stone or rock cannot be obtained economically.

If a series of thalsperren has been built so that the line connecting the foot of the upper one with the top of the lower one corresponds to the profile of equilibrium, *i. e.*, the grade on which the water is not able to carry away any more detritus, then it is evident that the detritus carried by the torrent will lodge above the thalsperren. If these thalsperren are sufficiently high, and the river-bed has been widened by the deposits, and the water is compelled to run in the center of the thalweg, away from the shores, then the problem of the permanent improvement of the torrent is solved.

But as the grades of the torrents are generally very steep, the distance between two such thalsperren would be very short, and the number of thalsperren necessary to arrive at the desired result very great, which would involve a heavy expense. Therefore, all that can be accomplished, is to create the profile of equalization, and then construct such other additional works, which will prevent the the erosion of the deposits and the undermining of the shores.

Such works consist generally of strong hurdles erected lengthwise equidistant from the center line of the thalweg or the future river-bed, and of cross-hurdles, placed at regular distances, forming steps, the upper edges of which lie in the line of equalization. To prevent undermining of the cross-hurdles, they should not exceed 1.5 feet in height, and the toes should be protected with rocks. The brush in the hurdles soon takes root and sprouts, thereby securing the river-bed and breaking the power of the high water. The space between the longitudinal hurdles, and the shores, must be filled with earth, and be planted with willows set in rows under an angle of 45° with the center line of the torrent. Finally trees, driving deep and strong roots, should be planted.

Where stone is abundant, the hurdles are replaced by small thalsperren (2.3 feet high) of dry masonry (rustic thalsperren.)

The works so far outlined, have been employed successfully in France; they, however, refer principally to that class of mountain streams which derive their detritus solely by undermining the shores and eroding their own bed.

The other class of mountain streams, which receive their detritus from large accumulations of rocks, formed by the disintegration of the mountains or by glacial action, require additional works to neutralize the damaging influence of the continuous supply of material. These consist in the retention of the same near its source, or if this is not possible, in its storage near the foot of the mountains. The remedy in the first case is a restraining dam, a large thalsperre (in contradistinction to this kind, the previously mentioned thalsperren are called "consolidation thalsperren") built up in the mountains, or in the second case, a storage reservoir for the detritus on the talus of the torrent, or at some other convenient place. As the restraining dams are built for the purpose to store as much detritus as possible, it is important that they should be built below places with gentle grades and of large lateral extent. They must be constructed so that they can be raised from time to time, by either putting a new section upon the thalsperre continuing the same slope, or by building a new one a little back of it. This latter method has the advantage that by the succession of steps the power of the falling water is broken; also that in case of injury or break of one of the steps, the whole work is not endangered. The above-mentioned storage places have the purpose to receive all the detritus not restrained by the upper thalsperre. They consist of dams or levees, enclosing a larger or smaller area, with a waste-gate at the lower end, through which the clear water runs off. When the place is filled with detritus, trees are planted and another storage place is prepared.

Drainage of Sliding Slopes.—Permeable ground resting upon impermeable sub-strata frequently slides after a rainfall. To prevent this, the rain water should not be allowed to percolate the ground, which has been accomplished successfully by means of drainage channels or ditches. In one instance in France four large ditches were excavated with a grade of 15 feet in 100 feet, into which a number of secondary drain ditches emptied. The main ditches were about 3.28 feet deep and 2.2 feet wide in the bottom. The bottom was well paved and the ditch then filled up, first with large stones, then with coarse gravel and finally with fine gravel. The secondary drains were constructed similarly; they were 2.3 feet deep and 1.3 feet wide in the bottom.

These drainage works have been very successful when used in time, and great expense

FIG. 2.

saved thereby. They should be made as near as possible to the sources in the high mountains where slides have caused small depressions, and which are liable to retain large portions of the rainfall and snow. In the perimeter of Saniéres the cost of such drains was:

		Secondary ditches.
Excava. per 1 running ft., main ditches	7 cts.	2 cts.
Pavement " " " " "	3 cts.	1.5 cts.
Filling " " " " "	1.6 "	5.5 "
	11.6 cts.	9.0 cts.

Similar drainage ditches have been used extensively in Austria, and when constructed properly, have been always successful in preventing the formation of slides.

Protection of Very Steep Slopes.—To secure and protect very steep slopes, a series of narrow horizontal berms with vertical slopes and the bottom inclined towards the mountain

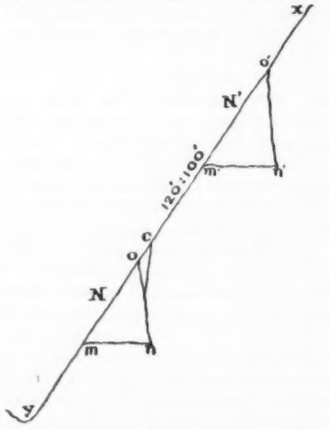

FIG. 3.

along the side hill (Fig. 3) are cut. A laborer places plants upon the berms *m*, *n*, so that their roots are about 4 inches distant from the outer edge; he then covers them with a little earth, which he takes from the slope *o*, *t*. Another laborer prepares meanwhile the next higher berm and throws the dirt excavated upon the first berm until the same is completely filled. This operation is repeated until the entire slope is secured. After two or three years the ground filled in is fit to be planted with fir trees. The ground between the fir trees is used for grazing (Fig. 2). The cost of these berms, including planting, was 53 cents per 100 running feet.

Treatment of Very Steep Parts of the Stream.—Where the grade of the torrent is too steep to allow the erection of regular thalsperren, a construction was used which is shown in Fig. 4. The entire work was of dry masonry, with the exception of the thalsperre, which formed the base of the whole system and was built in mortar. In the case illustrated, the original grade of 37 feet in 100 feet was by this means reduced to 11 feet in 100 feet.

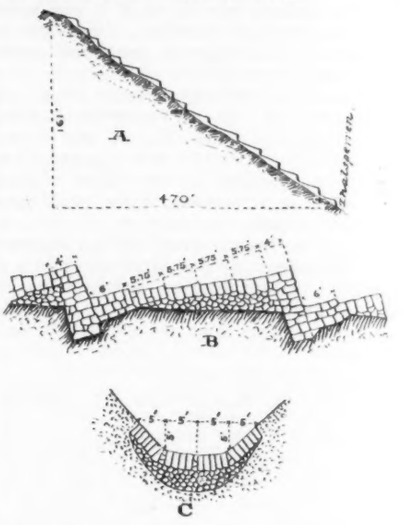

FIG. 4.

In those instances where one shore consisted of solid rock, and the other of loose material, spurs of dry masonry were built, by which the current was forced over to the solid rocky shore.

French Laws Referring to Mountain Streams.

The first laws made in France, in reference to the improvement of torrential streams, are dated from July 28, 1860, amended June 8, 1864. Under these laws the Government granted subsidies to the amount of three million dollars for the execution of the necessary works. Both these laws were abandoned in 1882. The present law dates from the 4th of April, 1882. Its main points are:

1. The improvements can be done either by the Government, by private individuals, or by an association, with subsidy from the Government.

2. The "public benefit" of the projected improvements can be declared only by law.

3. The whole work must be done under the control and supervision of the Government, and after a plan worked out and approved by the same. All the needed ground must be purchased by the Government by agreement or by condemnation. The maintenance of the improvements is under Government supervision.

4. During the first twenty years no trees are allowed to be cut. The forests planted in course of these improvements are exempted from taxation for a period of thirty years.

5. Where a tract of land is not yet so badly denuded and devastated that immediate improvements are necessary, the same is "reserved" and cannot be used for pasture or agriculture for a period not exceeding ten years. Should it be desirable to extend the time, the land must be bought by the Government.

To show the liberal appropriations made in France for public works, it may be mentioned that the Legislature of 1873 appropriated a sum of $166 500,000 for the improvement of the rivers and the extension of the canals. Of this sum $87,000,000 were to be used for improvement and maintenance, 57,000 000 for the construction of new canals, and the remainder for other work, to be expended during a number of years. This is the great advantage the European countries have over us, that appropriations for public works are made at once for the entire extent of the same, and not from year to year. There the designing engineers see their way clear ahead to the completion of the intended work, and can make their project and plans accordingly, after a thorough and well studied system.

6. When the improvements have been completed, the use of the improved land for pasturage is subject to certain regulations.

The execution of this law is under control of the Department of Forestry. At the head of the special branch of this department is at present the celebrated specialist P. Demontroy (*Chef du service de reboissement*). He is aided by one Chief-Assistant (*Inspecteur*), two Assistants (*Inspecteurs adjoints*) and two Clerks in the head office. The field work is done by parties of five to six persons each. At present there are eighteen such parties with sixty-three officers.

After the improvement works have been completed, and the new forests are old enough to be used for commercial purposes, the party is dissolved and the district is turned over to the General Department of Forestry or to the Department of Roads and Rivers. This organization has many advantages, the entire work being projected and carried out by one and the same officer. The officers of this service are educated at special schools.

Now what can we learn from the above statements in reference to our conditions here in California?

Two of the principal causes of the damaging high waters in Europe have been the inconsiderate destruction of forests and the unrestricted use of the mountains for pasturage of sheep and goats to the final extinction of all vegetation. Both the wood and lumber business, and the raising of sheep and goats, are important industries, upon which the inhabitants there largely depend, and which have been the first cause of settlement of these mountainous districts (similar to the gold mining in California). The continuous and unlimited prosecution of these two industries has finally become disastrous to the lower valleys by the immense masses of detritus carried down by the torrents—which became the more powerful the more the timber was cut and the more the mountains were used for pasturage—covering large areas of the best arable land, raising the bed of the rivers and thereby increasing the danger of floods. The Government, being annually called upon for assistance by the damaged communities, began to study the causes of these devastations, and arrived at the conclusion that remedies applied to the very source of the evil only would secure permanent success. The forests were replanted and new ones started, the threatening slopes were secured and protected, and the grade of the torrents was changed to the grade of equalization. The use of the new and replanted forests and pastures for purposes of industries was not prohibited entirely, but was simply regulated and compelled to keep within certain limits.

This condition of affairs is somewhat similar to that in California, with the following facts in favor of this State. 1st, the grades of the mountain streams are comparatively gentle here and their beds wider than those before mentioned, and 2d, the devastation of the forests has not as yet attained such proportions as in Europe. It is popularly assumed that all the detritus flowing down the Sacramento and Joaquin rivers alone comes from the hydraulic mines. Sufficient observations have not been made to establish the correct proportions of detritus, derived from the different sources, but the facts above related lead to the belief that here also a large amount of the sediment in the rivers is due to what is called "natural wash." The same forces which are at work in Europe to deteriorate the water courses, with all the injurious consequences, are also at work here. Trees are cut without restriction and none are ever replanted.*

Considering all these facts, it seems to the writer that a system similar to that of France could be adopted here. The State and General Governments should join in a very extensive and careful examination of the question, not only of hydraulic mining and the damages done thereby, but of all questions concerning the injuries done to the navigable rivers, and to the valleys above them, including the effects of the many improvements made in the lower Sacramento and San Joaquin valleys in the form of levees and other reclamation-works. These valuable swamp and overflowed lands cannot be reclaimed permanently by treating them as a separate division, but only as a part of the whole system. The improvements should commence in the mountains, and gradually be carried down to the valleys.* The work should be carried out according to a well studied plan, based on absolutely reliable facts only. The investigation should not be restricted to a short time, because careful and detailed studies are necessary to success. Immediate results cannot be expected, as the question at issue is of such a nature that only time will prove the value of the improvements. The maintenance as well as the construction of the improvements must be under the supervision and control of engineers. The most important duty of the engineer, engaged in the treatment of rivers, commences when the works of improvement are finished and their effects can be studied. How far we are yet from being able to determine beforehand the effects of works of improvements in rivers, is demonstrated annually by the devastations of freshets and floods. The improvements should be made under joint control and supervision of the State—and General Governments. The necessary means should be raised by subsidies of both governments and by a special State tax. The latter seems to be justified, as the rivers are the arteries of the State, and as the permanent improvements of the rivers will increase the production, cheapen transportation of the farm products, and attract a large immigration, thereby raising the value of property over the whole State.

By carrying out some improvements similar to those in France, the hydraulic mines could be allowed to continue their work, they being restricted to a certain maximum of gravel to be washed annually. This maximum should be established from year to year by a commission, consisting of representatives of the respective districts and of the State and U. S. engineers in charge of this work, and be ascertained according to the amount of detritus which can be stored by the additional improvements contemplated. The largest portion of these annual expenses (say 75 per cent.) should be borne by the mines, and the rest be contributed by the State and the United States. The restricted and limited working of the mines would be better also in that respect, that it would create a permanent industry, and contribute for a long time to the wealth of the State, instead of being worked with nearly feverish exertions for a few years only, leaving behind nothing but deserted and abandoned mining camps. A slowly but steadily increasing industry is certainly a better base to build a State, and a permanent and prosperous community on, than one which is prosecuted a few years with all the energy that men are capable of, and then dies after a short brilliant existence.

That such restrictive laws are constitutional and can be enforced is proven by the game laws. The various animals are protected by them, so that they may propagate themselves and continue to give food and enjoyment to the living and following generations. Why not protect man also, in his posessions by a similar restriction of an industry, which is liable to damage him if prosecuted without such, but if stopped entirely, seriously curtails the resources of our State?

An additional remedy to those employed in France, which could well be used here, is that of reservoirs, where a large amount of the rain water and of the melting snow could be stored, until the rivers below are capable of carrying it off without overflowing their banks. Their discharges should be regulated by the carrying capacity of the rivers. Such a system is now contemplated to be built at the headwaters of the Mississippi, the St. Croix, Chippewa and Wisconsin rivers. President Whittemore, in his address to the annual convention of the American Society of Civil Engineers, held last month at Buffalo, says in reference to this project: "Should the experiment prove successful to the degree anticipated, it may then be of moment for us to determine how far any similar plan may be applied, not only for the purpose of aiding navigation, but in ameliorating the condition of those many portions of our country periodically subjected to destructive inundations, often attended, as recently, by the loss of many lives and millions of dollars in property.

The rivers of California require speedy improvement whether hydraulic mining is continued or not. The above statements will therefore be instructive in either case. The writer is not prepared to go into further details bearing upon this question—all he desires is to call the attention of the members of this Society to the above stated facts, and their profitable application to our State. A thorough discussion of this question, and eventually actions taken by the Society toward the proper legislation, would largely contribute to its solution.

* The State Engineer estimates in his report of 1880, that in the year 1879, 4,900,000 cubic yards of sediment in the Sacramento river were due to natural wash, and 13,200,000 to hydraulic mining. Col. Mendell, in his report to the Secretary of War, January, 26, 1882, says: "A comparison of artificial denudation in mining with that due to natural agencies, if it could be fully made, would be a profitable and interesting step in this investigation. Unfortunately, the data for the determination of natural denudation in the Sacramento basin do not exist." Then, after making a few deductions by analogy with the natural wash of the Mississippi and Po, Col. Mendell says on page 28 of the same report: "These general considerations are calculated to convey to the minds of those familiar with the natural circumstances of rivers as clear a conception of the magnitude of the problem as would be afforded by a study of its details. They explain the accumulations in the river beds, by making it evident that mining operations contribute more material per year than the floods of that year are able to carry. It also becomes plain that if the mining were to cease now, the flood being able to transport considerably more material than that due to natural erosion, would then be in a condition to attack deposits in the beds, which are comparatively safe so long as the floods are overloaded, as they now are." M. Manson says in his report to Col. Mendell (dated Jan. 5, 1882): "The natural or unavoidable wash from the basin of Feather river is great and the wholesale stripping of the fine timber districts and the unrestricted pasturage of large herds of stock renders this wash greater year by year."

The Proposed Prince Edward's Island Tunnel.

From a description furnished the *St John's Telegraph* by Senator Howlaw, who has been vigorously pushing the scheme, we extract the following data relating to this rather ambitious tunneling project:

When the island province of Prince Edward became a part of the Dominion, one of the terms of the arrangement was that regular communication with the mainland was to be maintained winter and summer. The summer traffic was easily arranged for by a line of steamers subsidized by the Dominion government, but the keeping open of communication in winter is a difficult matter. Owing to the immense quantities of floating ice passing through Northumberland Strait, mails are transferred by ice-boats but; this is dangerous traveling for passengers, and serious accidents are not infrequent.

The tunnel now proposed to overcome these difficulties would be located between Capes Traverse and Tormentine, the width from shore to shore being about eight and one-half miles. A survey shows the depth of water on the line to vary from one to twelve fathoms, with an almost level sea bottom, excepting a hole or sudden depression near the New Brunswick shore. The bottom is sand for about twelve feet in depth, and then comes sixty feet of a tough "brick clay."

The promoters expect to decrease the length of the tunnel proper by running out piers from each shore, one and one-half miles on the Prince Edward side and two and one-half miles from the mainland, to thirty feet depth of water. Among the methods of tunneling proposed, and the apparantly most favored plan, is that patented by Haden H. Hall, of New York, and already fully described in this journal. The description quoted, however, says the tunnel "will be sixteen feet in inside diameter which will give ample room for a railway of standard gauge." This is either a misprint, or a very close fit is expected. The projectors estimate the cost in total at$3,-000,000, which we should say is also "a close fit."

European Navy Yards.

Naval Constructor Philip Hichborn, U.S.N., who was sent last year to visit the principle dockyards of Europe, has submitted to the Secretary of the Navy a long report. It is said by high naval authorities to be a work of great practical value. He visited the yards of Great Britain, France, Germany and Russia. He describes technically and with much detail the shops, docks, discipline and working systems of these institutions and the vessels lately finished or in process of construction. His report is illustrated with photographs, charts and fine drawings. He says that in the National dockyards of Great Britain about 18,000 men are employed, their average pay per day being $1.03. The total sum expended by the British Government in the last fifteen years in the construction and repair of vessels of the Royal Navy aggregates $179,649,625, with incidental charges which swell the total to $217,-319,275, or about twenty-eight-one-hundredths of the total naval appropriation for the same period.

The Imperial Navy of Germany dates from October 1, 1867, from which time up to the present about $140,000,000 has been expended upon the naval establishment, with the result that Germany now ranks as the fourth naval power.

The navy list of Russia makes that country third in the rank of naval powers. The apparent navy aggregated at the beginning of the present year 370 vessels of all descriptions, but a cursory examination revealed the fact that probably not more than 120, exclusive of torpedo boats, can properly be classed as vessels for offensive and defensive wartare.

France has five dock yards collectively comprising an area of 900 acres. She has twenty-four dry-docks, and her establishments are complete in all the requirements for building, repairing, fitting out and preservation of ships and the manufacture of stores and articles required for a navy. The quays, basins and slips are of the most substantial character, which, if duplicated in the United States would require decades and several millions of dollars. Convict labor has been largely utilized in such National work, while beside the wages of free labor are sufficiently low to accomplish a great deal of work at an outlay which in this country would be regarded as insignificant.

In his chapter upon topedo boats Mr. Hichborn says these vessels are now considered so essential that no European navy of note has a flotilla of less than fifty, while the stronger powers have fleets of a hundred or more. Coasts nave been divided into torpedo districts of a hundred or more, each with its complement of boats, and the crews thoroughly organized, are kept continually exercised in the management of the vessels. Of the seaworthiness of such boats he says there can no longer be any doubt; their long voyages in some cases under steam and in others under sail to Rio Janeiro, Buenos Ayres and the Black Sea having conclusively demonstrated their ability to survive very severe weather. Lately, during an evolutionary cruise of the French Mediterranean squadron, the torpedo boats were able to keep the sea while the Tonnere and Vengeur, large ships, were compelled to seek shelter from the violence of the gale. The defensive value of a fleet of cruising torpedo boats, he says, can hardly be overated. No blockade can be maintained in their presence, yet, if properly supported by tenders with a coal and supplies, they form of themselves an efficient blockading force. The cost of one such a boat completely equipped is from $60,000 to $65,000 and they require from ten to fifteen men. To operate to the greatest advantage they must attack in numbers; it is not sufficient to supply each port with one or two. It is probable that in the future no ironclad will venture to attack a port without the assistance of a torpedo flotilla equal or superior to that possessed by the enemy.

In describing the details of the construction of torpedo boats, he says some attention has lately been given to their propulsion by electric motors. In a launch 40 feet long and six feet beam, recently constructed, a speed of 8 statute miles was obtained, and sufficient power was stored in the secondary batteries for a run of several hours. The silence of this mode of propulsion, the fact that power may be stored in the least useful portions of the vessels, the absence of sparks, and the ease with which the boat may be charged by the dynamos now on board almost all large ships of war, he thinks, renders this a somewhat promising field for further investigation.

He found the owners of private yards in Great Britain, after a year of unprecedented prosperity, marked by the output of a million and a quarter of tons, feeling severely the effect of the present depression of the carrying trade—some were but half employed, many were quite idle, and only a few could be said to be fairly busy. These latter, he noticed, had the finest and often the largest establishments, equipped with the best of labor-saving tools. The construction of sailing vessels appeared to be proportionately less depressed than that of steamers. In his description of ships built and building, he has the following comment upon the Chilian Esmeralda: "For offence the Esmeralda is powerfully equipped, but she is vulnerable throughout, and there can be no doubt that even a lightly armed antagonist could play havoc in the machinery spaces and destroy or dislocate the delicate hydraulic mechanism by which the heavy guns are worked. . . . On account of her small coal supply, vulnerability, unsheathed bottom and insignificant spread of sail, I am unable to see the propriety of building similar vessels for the American navy."

Of the work and the workmen in British private yards, Mr. Hichborn says: "The bulk of the work is given out to the men in small contracts. Day wages seldom amount to more than 60 to 65 per cent. of what the same trades receive in the United States. In the Royal dock yards the matter of wages is somewhat amended, much of the labor is day work, and the employers have considerable attention paid to their comfort. About one-third of the men are called established, and have a pension to look forward to when advanced in life and incapacitate—a wise provision, encouraging good conduct on the part of the men and rendering a strike in the dockyard an impossibility. The average hired man in the government yards gets three shillings 5 pence per day, and the average established man gets 4 shillings 6½ pence. A leading man of shipwrights gets 6 shillings 6½ pence."

"In France," Mr. Hichborn says, "wages are extremely low and the condition of the workingman is correspondingly depressed. In the dock yards laborers get about 30 cents per day, blacksmith's helpers 35 to 45 cents, a second class shipwrights 45 to 55, and a very competent ship wright may get 80 cents. Average blacksmiths, fitters and turners get about 60 cents. A competent smith will get 80. After years of service, when looking forward to becoming a foreman, he will get $1 per day, but no foreman gets more than eight francs, or $1.60. After twenty-five years' employment every workman is entitled to a pension which is two-thirds of his greatest pay."

In conclusion Mr. Hichborn says: "A naval war would doubtless demonstrate that the elaborate schemes of fleet tactics which have been the theme of many essays by naval officers, have been chiefly valuable as a mental exercise, and that though importance may attach to a skillful disposition of forces in the beginning of an engagement, yet, in view of the rapidity with wnich vessels would be disabled by the tremendous means of offence antagonized and the inability to see or obey signals amid the confusion and obstructing smoke, it is evident that such an engagement must presently become a pell-mell scrimmage. Such a war, on one such battle, would prove what has long been the apprehension of intelligent officers—that the war ship of our day has become far too complicated for the people who may be called upon to work her, and that a balance of advantage, unsuspected by many rests with that vessel which has comparative simplicity, even though it be concomitant with a greater apparent exposure of life or lower and produced power of offence."—*N. Y. Tribune.*

NEW ORDNANCE MATERIAL*

Official Report to the U. S. War Department.

BY WM. H BIXBY, CAPT. OF ENG'S., U. S. ARMY.

(Continued from page 275.)

SUMMARY.

The advantages, objections, possible modifications and probable use of the new gun may be summed up as follows:

Advantages.—The gun-casemate gun, especially in its improved form (see Plate 5) possesses over all other styles of mounted guns a great superiority with respect to the complete protection of its cannoniers, and the rapidity and accuracy of its fire against a moving object.

A gun of 15.5-c.m. (6. 1-inch) caliber, firing 40 to 50 shots in immediate succession at half minute intervals, and with the same accuracy as of any other sharpshooter rifle, is certainly an invaluable adjunct to the defence of a river channel or a harbor entrance, where time is an element of immense and of vital consequense, where under cover of fog, smoke, or even of the mere darkness, an enemy's vessel may remain but a few moments in reach of the fire of the defence. With three or four times the accuracy, and five or six times the rapidity of his fire, such a gun-casemate gun might well hold its own against an overpowering enemy on its water front.

With the exception of gun, front plate, and mantelet, all the pieces of this gun-casemate gun can be readily made by our home manufactories; the construction of the less important parts are exceedingly simple, and the whole can be set up in place in a very short space of time. Spare pieces can be easily kept in store, near by, ready to be mounted in time of emergency by our ordinary workmen.

With respect to any damage from the enemy's fire, the iron front plate has resisted satisfactorily the tests to which it has been subjected; viz:—A fire from the 12-c.m. (4.7-inch) and 15-c.m. (5.9-inch) calibered projectiles. Whether the thickness of metal, and the material of plate, can be advantageously changed, seems to be a disputed point; against guns of less power than 8-inch rifles, the ques-

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tion is one of the cost, rather than of the resistance of the armor; against the fire from heavier guns, the gun-casemate construction still has as many advantages and as few disadvantages as any other method in use for mounting guns behind a soft iron armor. It appears at present extremely improbable, that any soft metal of to-day's construction, obtained at any reasonable cost, will be able to resist successfully the modern projectiles and their more destructive bursting charges.

Objections.—The objections to the gun-casemate gun in its part forms are that:—

1st: with the past construction of the socket piece, and the difficulty of its withdrawal in case of accident, the piece and casemate may be rendered unserviceable by 12-c.m. (4.7 inches) explosive shells, and 15-c.m. (5.9 inches) hard pointed shells, if striking upon the surface usually covered by the exterior mantelet. At the same time, the front plate is either not hard enough, or not thick enough near the embrasure, to properly prevent such hits from causing undue pressure on the ball-head and socket piece.

2nd: no satisfactory exterior mantelet has yet been obtained.

3rd: a shot striking in the peep-hole or close thereto, may render it unserviceable and thus force the cannoniers to return to the old method of aiming, through the bore, thereby reducing the accuracy and rapidity of fire against a moving object.

As to the first objection:—it is possible that the newly proposed form of socket piece may permit its gradual withdrawal in case of undue pressure on the front of the ball-head. In such case, the gun would continue to be serviceable until itself broken; which could only be done by a shot striking in just the right spot on the exposed surface of its ball-head; even then, the gun could be replaced by another, and the casemate would remain in action as long as the front plate remained standing.

As to the second objection: The exterior mantelet is evidently an essential feature of the casemate when the latter is used for land fronts; but the mantelet is by no means essential when the gun-casemate gun is used simply for the defense of harbors, where it can be so placed as to be sheltered from all fire, except that coming from the deck of an enemy's vessel; the chances are exceedingly small that the casemate will then be hit by a destroying shot in its vulnerable parts, as the latter even in the absence of any mantelet are at the greatest 0.60-c.m. (25.2 inches) in height, and 1.0 meters (39.4 inches) in breadth for the 20.9-c.m. (8.23 inches) gun; moreover, if the material about the embrasure can be properly reinforced, or hardened, this vulnerable portion will be reduced to a spot whose diameter is less than twice the caliber of the piece.

As to the third objection: All guns are liable to have their sights injured. In order therefore to place this gun above reproach, it is simply necessary to provide: on the one hand, an equally efficient but more easily removable socket piece; and on the other hand, a better exterior mantelet. In other respects the gun is mechanically a success; all questions as to its adaptability to use with or against larger calibered guns, (*or even as to its being converted into a machine gun*), are mere questions of money.

Possible Modifications.—Front Plate. The construction of the front plate has called up many criticisms, most of them being upon the material used.

Although the question of armor plate construction has been under discussion for many years, and it is not yet definitely decided; still, it seems to be generally conceeded that wrought-iron plate if thick enough will, though deformed by the projectile, prevent the latter from getting through; that chilled cast-iron if thick enough will, although perhaps cracked by the projectile, keep the latter out; and that steel-faced wrought-iron, or chilled or tempered steel, may possibly be so made as to combine the advantages of both, though at an increased cost. In the gun-casemate gun, when solidarity of gun and front plate is an essential feature, deformation of metal might do no harm, cracking of metal would be fatal. This latter consideration alone seems to demand the use of a ductile or semi-ductile metal; the only question, then remaining, is whether it can be made thick enough. For resistance against 15-c.m. (5.9-inches) and 20 c.m. (7.9 inches) projectiles, this thickness is already attainable in existing rolling mills; greater thickness will undoubtedly follow if called for in sufficient quantities. The writer has already seen, in the work shops of Brown at Sheffield, a 12-inch steel-faced plate bent to an inner radius of 6.5 inches; a similar plate might be advantageously used for the front plate of a gun-casemate gun.

As to the position of the front plate: Future constructions, instead of inclining, will undoubtedly place their front surface vertically, in order to receive more obliquely the enemy's shot.

As to the horizontal cross section of the front plate: A horse-shoe figure would undoubtedly be far better for deflecting the enemy's shot as well as for strengthening the attachment of the socket piece. The rectangular shape is, however, much more easy to construct, and consequently much less costly.

Socket Piece.—The only probable modification of the socket piece, seems to be that already proposed, viz:—an increase of its diameter from the front to rear of the plate in steps, restricting the use of its screw-thread to the rear portion alone. Something must be done to allow of the removal and withdrawal of this piece after injury to the gun; as one essential requirement of a casemate-battery is that its damaged guns may be withdrawn and replaced.

Exterior Mantelet.—The present form and construction of mantelet is hardly satisfactory; but nothing appears capable of better answering the severe requirements demanded.

The use of chilled-cast-iron, or cast-steel, is almost impracticable, on account of their liability to be cracked under fire, both of these metals require to be arched or vaulted, and to be firmly held in place by abutment pieces. Nothing has been found, as yet, better than wrought-iron or wrought-steel.

In all cases, arrangements should be made for rapid and easy replacement of the mantelet as soon as damaged by the enemy's fire. Such arrangements demand certain alterations in the form of the present glacis plate.

Conclusions.—If the objections, above alluded to, are removed by suitable modifications, the gun-casemate gun must certainly play a prominent part in and become an essential element of the future defence of all fortifications, both on land and sea fronts.

It must be remembered that the largest gun of this style now existing is the 15.5-c.m. (6.1-inch) caliber gun; the 20.9-c.m. (8.2-inch) gun, (of which details are given in the Austrian Construction Details) has never been constructed, except on paper. The manufacturer states: that he believes the same style of construction can be applied with success to the largest gun, but adds that the cost of such construction would increase rapidly with the caliber of the gun.

In its present form, its value as an element of land defence rests a matter of doubt; but it would seem, on account of the complete protection of its cannoniers, the ease of its manœuvre and the great rapidity and accuracy of its fire, that for rivers and harbors in places where land fire can be avoided and where 15.0-c.m. (5.9-inch) and even 30-c.m. (7.9-inch) guns are desirable and sufficient, at e t a few guns of this style of construction would be invaluable; and that, under the above circumstances, they (even if without mantelets) would give a more efficient active defence, than could be obtained by the same amount of money spent in any other style of gun firing a projectile of the same penetrating power.

Bibliography.

Geldern-Egmond.—"Ueber die neuesten Versuche mit Eisenpanzern etc." (Lecture originally delivered by Major Graf Geldern-Egmond, of the Royal Austrian Engineers, at the circle of military science at Vienna, Febuary 1st, 1878, and then printed in part 3, Vol. xvi, "Organ der militair-wissenshaftlichen Vereine," Vienna, 1875; it was afterwards translated into French, and appeared in pages 106 to 129 (1 plate), part 2, of the "Revue Belge Militaire" for 1878, under the head "Expériences nouvelles sur les cuirassements en fer et leur emploi en fortification.")

d'Ursel.—"Canon Krupp à cuirasse;" by Major Graf Geldern-Egmond, Austrian Engineers; translated into French by Count Aymard d'Ursel, Lieutenant French Artillery; and published in pages 109 to 119 (2 plates), part 1, "Revue Belge Militaire", for 1878.

d'Ursel.—Expériences d'Artillerie dans les polygones de M. Krupp; by Count Aymard d'Ursel, Lieutenant, French Artillery; published in pages 1 to 12 (3 plates), part 1, "Revue Belge Militaire", for 1879.

Orde-Browne.—Krupp's Meppen experiments of 1879; by Capt. Orde-Browne, English Artillery (retired), published in pages 271 to 290, (1 plate), part 4, Vol. II, "Proceedings of Royal Artillery Institute", for 1880.

Maitland.—Krupp's patent protected non-recoil system; by Major E. Maitland; published in pages 66 and 67 (1 plate), Vol. 10, "Proceedings of Royal Artillery Institute", for 1879.

Krupp.—Exéperiences de tir avec le canon cuirassé de 15-c.m., exécutées en Octobre et Novembre, 1877; published by Krupp, 1877.

Krupp.—Krupp's Iron fort and muzzle-pivoted gun; pages 1 to 7, 4to. (no plates); published by Krupp, Essen, May 1879.

Krupp.—Schiess-Versuche mit Krupp'sche 15.5-c.m. Panzer-Kanone auf dem Schiessplatz bei Bredelar, 28sten Juni, 1878; published by Krupp, Essen, 1878.

Krupp.—Muraille-cuirasse et canon-cuirassé en fer forgé-système Krupp; published by Krupp in May, 1879.

Krupp.—Expériences de tir de l'établissement Krupp, exécutées au polygone de Meppen au mois d'Aout, 1879; 1, Vol. 4to, (6, plates 3 photos); published by Krupp, Essen, 1879. Republished in pages 481 to 544, part II, of "Mittheilungen ueber Gegenstænde des Artillerie-and Genie-Wesens," Vienna, 1879.

Brassey.—British Navy; pages 67-66, Vol. 2.

Austrian K. K. Military Committee.—"Constructions-Details der Kriegsbaukunst," Vienna, 1880 (part 5, Vol. 2, contains three fine plates of the Krupp "Panzer-Kanone").

U. S. Ordnance Notes, No. 126, Krupp experiments up to 1879 (translation into English by Lieutenant Borup, U. S. Ordnance: pages 368, 380, 382, 409 and four plates refer to the gun-casemate gun).

U. S. Ordnance Notes, No. 113, trial of Krupp guns, extracted from London *Times* and *Standard*, August 1879, (pages 135, 6, 8, refer to the gun-casemate gun).

London *Engineer*; page 19, January 10th, 1879, (contains wood cut showing the appearance and use of the gun in harbor and river defence).

(TO BE CONTINUED).

Every man should learn how to be a consummate "Business Man."

The "Porte de France" Cements.

BY CHARLES TALANSIER.

The Porte de France natural cement rock is obtained from quarries on the summit of Mt. Jalla, near Grenoble, France, and the following description of its properties and application is translated from an article in *Le Genie Civil*, of October 10:

The rock upon analysis gives the following results:

Clay	Silica	13.3	23.7
	Alumina	5.1	
	Peroxide of iron	2.6	
	Lime	1.7	
	Magnesia	1.0	
	Carbonate of lime		76.3
	" of magnesia		
	Water, bitumen, etc.		
			100.0

The cements made from this rock are of four different kinds; 1.—Quick Cement, quick setting; 2.—Natural Portland, medium setting; 3.—Artificial Portland; slow setting; and 4.—White Portland.

The quick setting cement, No. 1, is obtained by simply burning the Porte de France lime. An analysis gives the following:

Clay	Silica	22.10	40.31
	Alumina	18.21	
	Oxide of iron		traces
	Lime		55.98
	Magnesia		0.37
	Sulphate of lime		3.34
			100.00

Used pure this takes a set in five minutes and acquires rapidly a considerable resistance which is augmented with time following in its rate a parabolic curve. Among the special applications of this product we would mention:

1. *Water Conduits, under Pressure in Beton.* (Fig. 1.) The proportions here used per cubic metre (35.3 c. ft.) are, cement 500 kilos (1,100 lbs.), sand 0.50 cubic metres (17.6 cubic feet) and gravel 0.75 cubic metres (25½ cubic feet). The formula giving the thickness of the conduit in terms of its interior diameter is, $E = \frac{D\,H}{30}$. In this, E= the thickness expressed in metres; D= interior diameter in metres, and H= pressure of water or head in metres.

The company controlling the Porte de France cement devised, in 1843, the first of these systems of conveying water under pressure by cement conduits. In was a happy application and brought about a veritable revolution in the distribution of water.

2. *Conduits in Cement Beton for Electric Wires.* In 1882, the Porte de France Cement Co. obtained patents for a system covering the use of pipes made of cement beton, with open tops and put together in the trench in lengths of one metre (3.28 feet) and hermitically sealed after the electric cable was in place. (Fig. 2.) This system was tried, in 1882, at Toulouse for telegraph wires, and at Lyons for telephones. The results were satisfactory, and the French government has now laid in this manner an underground telegraph line 62 miles long; the line was laid in three months. Other lines are now being laid, one of 24 miles and other for the conveyance of wires for electric lighting for the city of Saint Etienne. This last has a double pipe, as shown in Fig. 3.

3. *Conduits in Cement Beton for the Filtration of Water.* This system, patented in 1885, includes a conduit made in two distinct parts. (Fig. 4.) The filter *B C D* permits the water to pass through it, and the collector *B A E D* receives it, and passes it to any desired point. The upper portion of the conduit is made of a meagre beton composed of 150 kilos. of cement, and one cubic metre of gravel; the collector is made of beton proper, with 500 kilos. cement, 0.50 c. m. sands, and 0.75 c.m. of gravel to the cubic metre. The two portions of the conduit are made at the same time and have a great resistance against crushing.

4. *Sewers and Conduits not under Pressure, of large Section*: These conduits are made with a beton composed of 400 kilos. cement, 0.50 c. m. sand, and 0.75 c. m. of gravel per cubic metre. Their principal advantages are, rapidity of execution, regularity of form, the suppression of a cement lining, the slight thickness of the sides, rapid hardening, and the possibility of almost at once using the conduit for the circulation of fluids.

The cement used should set promptly, and be of a superior quality; otherwise, there is a risk of great masses of the beton falling off from its own weight, before it has had time to obtain a sufficient resistance or adhesion.

Natural Portland is also used for the lining of reservoirs, gasometers, etc., as the rapidly setting cement does not permit a sufficient dressing of the surface, where this is great. On the contrary, the slow-setting variety is applied with difficulty to vertical surfaces or the intrados of arches.

ARTIFICIAL PORTLAND CEMENT, QUICK SETTING.—Artificial Portland cement pure takes a set in three hours; it is thus easily applied even by inexperienced workmen. This product is practically the same in chemical composition as the artificial cements of Boulonge and England, as shown by the following table, taken from the report of M. M. Cendre, Bochet and Rahoult:

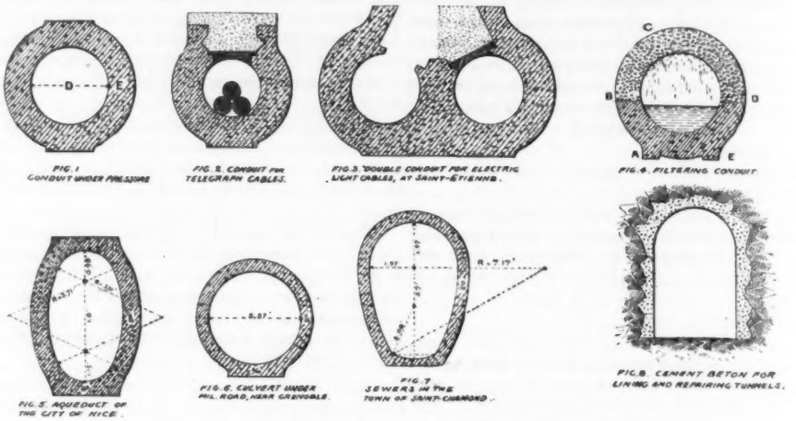
FIG. 1. CONDUIT UNDER PRESSURE
FIG. 2. CONDUIT FOR TELEGRAPH CABLES.
FIG. 3. DOUBLE CONDUIT FOR ELECTRIC LIGHT CABLES, AT SAINT-ETIENNE.
FIG. 4. FILTERING CONDUIT.
FIG. 5. AQUEDUCT OF THE CITY OF NICE.
FIG. 6. CULVERT UNDER MIL. ROAD, NEAR GRENOBLE.
FIG. 7. SEWERS IN THE TOWN OF SAINT-CHAMOND.
FIG. 8. CEMENT BETON FOR LINING AND REPAIRING TUNNELS.

Works in "Porte de Paris" Cement Beton.

The aqueduct for the City of Nice (Fig. 5), the culverts under the military road to Grenoble (Fig. 6), the sewers of Basle, Annecy, Saint Chamond (Fig 7), have all been constructed of this material.

5. *The Lining and Repairing of Tunnels in Cement Beton*, (Fig. 8). This system of tunnel-lining is rapid in execution, thus avoiding risk of accident; it also is much cheaper than masonry of any kind. If there is no danger from infiltration of water, a meagre beton, mixed one part cement to seven parts of gravel can be used.

In addition to the above uses of cement beton by the engineer it has been applied in other more modest but no less interesting cases. Among other uses, posts made of cement have been substituted for wood in supporting the vines in vineyards; at Saint Robert, near Grenoble, there are about 40,000 of these cement posts.

NATURAL PORTLAND CEMENT, MEDIUM SETTING.—The medium setting natural Portland cement of the Porte de France Company is obtained by reburning the cement rock. It gives the following analysis:

Silica	22.61	42.40
Alumina	19.79	
Lime		51.63
Magnesia		0.37
Sulphate of lime		5.60
		100.00

This cement, in a pure state, will take a set in thirty minutes and acquire in a short time a resistance to breaking by tension superior to that of the quick cement. But the latter is nevertheless to be preferred in all work which requires great rapidity in execution and removal of centers, such as conduits under pressure, etc.

In cases where it is advisable to somewhat reduce the rate of setting, the quick-setting and the natural Portland are sometimes mixed in certain proportions. The strength of the compound is then a mean between the two, partaking of the properties of the elements entering into the new product. The mixture of these two classes of cement produces an excellent artificial stone, the edges being sharp and the surfaces perfect.

	Artificial Portland Porte de France.	Chemical composition of seven cements of the English Portland and Boulonge varieties.
Silica	25.20	24.1
Alumina and Oxide of iron	11.40	10.3
Lime, total	56.00	61.4
Magnesia	2.40	0.5
Sulphuric acid, Alcali, Water, etc.	4.90	3.7
	100.00	100.00

This product is used for pavements, floors, etc. Streets and roads, constructed of beton and artificial cement mortar, give good results. There are a number of examples in the city of Grenoble where they have stood for fifteen years. The wear is less than upon ordinary pavements, and there is little noise from passing vehicles; it is easily kept clean, and the heat of summer and the frost of winter have no effect upon it. As this artificial Portland cement requires about one month to completely harden, in using it on much travelled streets, it is first moulded into blocks at the works, and these blocks are then set on a bed of sand and joined with cement mortar.

THE WHITE PORTLAND CEMENT OF PORTE DE FRANCE.—This product is almost white in color and is used in the manufacture of compressed paving-tiles or bricks, and to the jointing of white stone or marble.

The furnaces used in burning the cement rock of Mount Jalla are ovoid in shape, and have an average capacity of 60 c. m. (78 c. yds.) They are charged with alternating layers of the rock and anthracite coal from the basin of the Mure, in the proportion of about 250 kilos. (550 lbs.) of anthracite to 1000 kilos. (2,200 lbs.) of the raw rock, for the slow-setting cement; and 180 kilos. (396 lbs.) of anthracite dust to 1000 kilos, (2,200 lbs,) of raw rock, for the quick setting variety. The time of burning is very variable; it depends on the dimensions of the furnace, the size of the material, atmospheric conditions, and, above all, upon the chemical conditions called for. It may be approximately stated, however, that a furnace with intermittent firing will produce, per day and per cubic metre of capacity, 40 kilos. of cement,; and a furnace continuously fired will

produce 100 kilos. per cubic metre capacity per day.

On removing the product from the furnaces two kinds of products will appear, having practically the same chemical composition and only differing in the degree of burning. These are, first, the over-burned vitrified stones, of a black color and great density; these give the "natural Portland" cement, and are also used in making the "artificial" cement. Second, the burned, but not over-burned, stone, yellow in color and of an inferior density to the first; this gives the "quick-setting" cement. These varieties are easily sorted by hand, but care is taken to leave a certain proportion of the over-burned stone in that part intended for the manufacture of the quick-setting product.

After selection, the burned rock is reduced in size in a stamp-mill, and then passed to twenty-four pairs of horizontal wheels to be ground; the cement is finally stored in bins having a capacity of 20,000 cubic metres.

OUR MATHEMATICAL COLUMN.

CATS can count as far as three, crows as far as four, (tame crows to six), and heathen savages as far as ten. Far better for us would it have been if our ancestors had had four fingers instead of ten, for then our system of arithmetic would have been quadrenary instead of decimal, and numerical operations could be performed with less mental fatigue.

NICHOLAS SAUNDERSON held the professorship of mathematics at the University of Cambridge from 1711 to 1739. Although entirely blind from his birth, he succeeded in understanding and expounding the most complex mathematical investigations. In order to perform computations he used a board pierced with small holes, into which he inserted pegs, which by their position represented different numbers. He wrote a large work on algebra, and also one on the differential calculus. It is said that he thoroughly understood the mathematical theory of perspective.

THE oldest mathematical book is the Chinese Kiu-tschang written about 2,600 B. C. Next is the famous Rhind papyrus of Egypt, written by Ahamesu about 1700 B. C. This treats of arithmetic, algebra and geometry. In Algebra the subject was developed only as far as the discussion of equations of the first degree with one unknown quantity. In geometry, particular attention was paid to the subject of pyramids, that being a class of work upon which Egyptian engineers were extensively employed. A translation of, and commentary upon, this papyrus was published at Leipzig in 1877.

THE arithmetical notation of the Egyptians was similar to that of the Phoenicians, whereby distinct signs being attached to the unit, to ten, to a hundred, a thousand, etc., other numbers were expressed by a repetition of these characters. Thus let A denote unity, B ten and C a hundred, then the number 243 would be expressed by $CCBBBBAAA$. This system, like that of the Romans, seems very inconvenient for calculations, but doubtless the ancients succeeded in performing all the ordinary operations of arithmetic as well as we in these later days. Speculative calculations were rarely indulged in, and the Egyptian mind seems in general to have been of a practical character. In this they differed from the Babylonians.

DURING the last thirty years algebra has assumed a new phase through the labors of Cayley, Sylvester, Salmon, Brioschi, Hermite, Aronhold, Hesse and Clebsch Without a knowledge of the theory of binary forms, of invariants, of covariants, of determinants, of discriminants and of the syzygy, it is impossible to obtain a complete knowledge of the present status of the theory of equations. Sylvester indeed has emphatically said: "thoroughly understand the meaning of the word syzygy and the logic of algebra has become a part of your being".

DURING the past twenty years that spirit of doubt which is a characteristic of the present civilization has affected even the mathematicians, and has led them not only to closely examine the fundamental axioms of of geometrical science, but to ask whether space may not after all have more dimensions than three. The properties of a space of four dimensions have been discussed by means of certain algebraic gymnastics and wonderful things have been discovered. For instance, it is claimed to have been proved that in a space of four dimensions, a hollow elastic ball can be turned inside out without turning or stretching it in the least A space with such properties is not only marvellous but beyond our comprehension.

PROBLEM 16. (Proposed by Prof. J. V. Hazen, Dartmouth College, Hanover, N. H.)—An engineer being in want of a beam 20 feet long, capable of sustaining nine tons uniformly distributed with a factor of safety of ten when supported at its ends, sent to a timber lot of yellow pine for a log from which to cut the beam; required the diameter of the log needed. The log is to be the smallest one necessary and is not to be used in its cylindrical form.

F. Freyhold writes that his solution of this problem in our column for October, was incorrect, owing to an error in using the factor of safety in the formula. The following solution by S. P. Mitchell, gives the correct diameter of the log from which the strongest rectangular beam can be cut:

$$w = \frac{18000}{20 \times 12} = 75 \text{ pounds per inch}$$

$$l = 20 \times 12 = 240 \text{ inches}$$

$$S = \frac{9000}{10} = 900 \text{ pounds per square inch fibre strain (assuming the Modulus of Rupture of Yellow Pine to be 9000)}$$

$$I = \frac{bh^3}{12} \text{ Moment of Inertia for rectangle}$$

h = depth of beam
b = breadth of beam
d = diameter of log.

The moment of resistance is $\frac{2SI}{h}$.

The bending moment at center of span is

$$M = \frac{w l^2}{8}$$

so
$$\frac{w l^2}{8} = \frac{2SI}{h} \quad (1)$$

Substituting in equation (1) the above values

$$\frac{75 \times 240 \times 240}{8} = \frac{2 \times 900 \times bh^3}{12}$$

$$540000 = 150\, bh^3$$

$$bh^3 = 3600 \quad (2)$$

We know that $b^2 + h^2 = d^2$ (3)

So from equations (2) and (3) we find that for d to have a min. value that

$$\frac{b}{h^2} = \frac{1}{2b} \quad (4)$$

or
$$h^2 = 2b^2 \quad (5)$$

Substituting this value of h^2 in equation (2)

$$b^3 = \frac{3600}{2} \quad (6)$$

or
$$b = 12.16 \text{ inches}$$

Substituting this value for b in equation (2) we find

$$h = 17.21 \text{ inches}$$

and putting these values in equation (3) and extracting the square root, we get

d = 21.07 inches, the required diameter of the log. The above dimensions make no provision for the weight of the beam. Assume that weight to be 1200 pounds then the total load will be

$$18000 + 1200 = 19200$$

$$w = \frac{19200}{240} = 80 \text{ pounds.}$$

Substituting this value of w in equation (1) instead of 75 and developing as before we find

$bh^3 = 3840$ or as in equation

(6) $$b^3 = \frac{3840}{2}$$

so b = 12.43 inches
and h = 17.57 inches
and d = 21.52 inches

Assume that the timber weighs 40 pounds per cubic foot then

$$\frac{240 \times 12.43 \times 17.57}{1728} = 30.3 \text{ cubic feet.}$$

Actual weight then is $30.3 \times 40 = 1212$ pounds.
Assumed weight = 1200 pounds.
So the correct value for the diameter of the log is 21.52 inches.

PROBLEM 17.—Let A and B be two points whose elevations above a given bench mark M are to be determined, the distances MA, MB and AB being nearly equal. A line of levels is run from M to A which shows that A is 12 inches higher than M. A line is also run from M to B showing that B is 16 inches higher than M. Lastly a line is run from B to A which shows B to be 5 inches higher than A. It is required to find, by the Method of Least Squares, the most probable elevations of A and B above the bench mark M.

The Weight and Section of Rails.

A committee of the Roadmasters' Association has submitted the following report upon the "Weight and Form of Rail, with Joint:"

1. *Weight.*—For the rail of the quality at present manufactured, and to suit the present spacing of cross-ties, your committee would recommend two standard weights—60 pounds per yard for light and 70 pounds per yard for heavy traffic.

2. *Form.* They would recommend that the form be substantially shown on the attached drawing, the base to be equal to the height, and the radius of the top of the head to be the same as that of the fillet of the wheel, ½ inch preferred.

3. *Joint.*—Your committee do not feel prepared as yet to recommend a joint. The double angle splice makes a superior joint, but inasmuch as this subject is at present receiving considerable attention in railroad circles, and as there are good forms of joint which merit attention, they would recommend that it be discussed and continued to the next meeting.

The section adopted is the same as that adopted by the Pennsylvania Road, in accordance with a recommendation of the Master Car Builders Association. The radius is ½ inch, but regarding this point the Master Car Builders have not come to any decision. The height of the rail is 4½ inches, and the width of web ½ inch. Radius of the upper part of the head is 12 inches. Some of the members thought that it was an open question what the best rail was, and disliked the idea of the association going on record without having given both a practical trial. It was thought by others that the weight of the rail should be governed by the amount of traffic upon the different roads, and that a 75-pound rail would be about the thing for most of the roads in this country to use. The weight should not be considered as much as the quality of the rail, because, no matter how heavy it is, it is useless as soon as the surface becomes rough, and it must be removed. The only real reason for increasing its weight is in order that its stiffness may be added to, so as to enable it to carry the load required without danger of breaking. Its shape should be so as to conform as nearly as possible to the tread of the wheel. A heavier rail without increase of stiffness only added to the cost of article without enhancing its durability.

The other half of this subject, namely, "rail joints," was next given attention. Discussion was started after a motion to the effect that the angle bar is the best splice that was carried. The attempt to indorse the suspension of the angle splice was not so sucessful. It was believed by a good many that the suspended bar was what they would eventually come to, but that its present shape and their understanding of it was not just what its strongest advocates claimed for it. It was true that more timber could be gotten under the track when the joint was suspended. Wm. Dunn, of the Baltimore and Ohio, related his experience with a curve on his division. He could not get an angle bar long enough for his purpose, so he had an ordinary fish-plate made about 40 inches long, with which he made his joint. He put a good, stout tie under the joint and one at each side at the proper distance. This was done last March, and a spirit-level now fails to detect any change in it. He believed in heavy, good, strong bars, and men who understood their business to take care of them. Others thought that a suspended joint looked quite pretty on a new track, but it sresults in service were not so attractive. If a good one was attained, it certainly was a benefit in some respects, especially in the saving of material.

M. J. McInarna, New York, Lake Erie and Western, said that the best rail joint is that which supports the ends of the rails on the same principle as the one invented and manufactured by Mr. Clark Fisher. It forms a bridge across two ties laid 6 inches apart in the clear, and the rails are fastened to it by means of a U-bolt that holds them in place and prevents them from working up and down under every passing wheel. This working up and down is injurious to the ends of the rails. By the constant wear they become bruised, which causes pounding of the wheels and renders it impossible to keep the joint up in proper surface. This, of course, causes the removal of the rails while they are yet practically good. This he thought was the result wherever the suspension joint with the angle splice is used. He believed in putting a tie under the joint whether fish-plates or angle bars were used. Some thought that a suspension joint was serviceable when the plates did not exceed 24 inches in length. The matter was finally disposed of by the Association going on record by passing the resolution "that it is the sense of this meeting that the length of the angle joint should be 44 inches long, or to reach three ties, with a tie under the center."

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CLUBBING ARRANGEMENTS.

1886.

The "subscription season" for the most popular American Magazines is close at hand, and inquiries as to our proposed clubbing arrangements are being made. We beg leave to announce, therefore, that on and after JANUARY 1, 1886, the subscription price of ENGINEERING NEWS will be **$5.00** per year; until that date the price and clubbing rates with other publications will remain as given below.

We are now planning such improvements in ENGINEERING NEWS, and negotiating for special work to be done during the coming year, as will cost double any possible increase of income from subscriptions; the long notice of change which we here give enables nearly, if not all, present subscribers to renew at present rates. We intend eventually to publish a class journal which will acknowledge no superior in the world, and we feel so confident of the support of our present patrons that we have no hesitation in venturing on the greatly increased expense necessary to carry out our programme.

If an English engineering journal, carrying fifty pages of advertisements and twenty four of reading matter sells for $10, why may not an American journal of equal merit sell for at least half as much.

In order to accommodate such of our subscribers as may wish to subscribe for other periodicals, we offer he following terms until January 1, 1886: We will send to any address ENGINEERING NEWS at regular subscription price, **$4.00** and the following at the additional prices given:

	Net. Price.	Reg. Price.
Atlantic Monthly	$3.25	$4.00
Century Magazine	3.55	4.00
Harper's Magazine	3.25	4.00
Harper's Weekly	3.25	4.00
Harper's Bazar	3.25	4.00
Harper's Young People (weekly)	1.65	2.00
Popular Science Monthly	4.25	5.00
St. Nicholas Magazine	2.55	3.00
North American Review	4.10	5.00
Cassell's Magazine of Art	m 3.00	3.50
Cassell's Family Magazine	m 1.25	1.50

The Century Magazine commences its year with the November Number; Harper's Magazine commences with the December Number. Subscribers should renew these Magazines in October and November.

Subscribers to other publications clubbed with ENGINEERING NEWS, must notify those "other publications" direct, of change of address during the year. After we have transmitted for the year's subscription and had the subscriber's name and address properly entered on he clubbing lists, our connection with the transaction *ceases entirely*. Our margin of five cents on each subscriber does not allow for much extra expense in time and postage and stationary.

An American advertisement for twelve "express passenger locomotive engines," from R. M. Cameron, agent for the Government of New South Wales, shows that the hundred or more of American locomotives now in the Australian Colonies are doing good missionary work. The Englishmen of the Colonies have apparently been away from home long enough to forget some part of their "British home-trade instinct," and wisely conclude to buy in the market that can furnish for the least money the article that is best adapted to their needs.

THIS week the American Construction Company, lately building the South Pennsylvania R. R., closed its Harrisburg offices. This means the disbanding of the best engineering organization that was probably ever gathered together on an American railroad, taking it in all its various ramifications. We regret exceedingly that so excellent a body of engineers should be included among the victims of a deal between rival trunk lines. And while we can not always approve of the methods of "construction" companies in conducting their business, we can only praise the wisdom displayed by the American Company in the selection of its engineering executives, and again regret that their labors have been practically wasted.

THE Egyptian obelisk, the famed Cleopatra's Needle, now erected in Central Park, is showing signs of rapid disintegration from the climatic severity of a New World which was only discovered some thousands of years after this memorial stone had been finished and set up in far off Egypt. In the 4,000 years of its native existence the only wear on its surface was that due to the driving sands which have left their marks on the shoreward faces of the obelisk as it stood.

But five years exposure to American frosts have so damaged the monument that not only its appearance but its very stability is threatened. Flakes of stone are found scattered at its base, and other flakes, an inch or more in length, can readily be picked off with the fingers, and on the east side is a fissure three feet in length and deep enough to take a knife blade to the extent of two or three inches, with a finer crevice entering still further. The vein in which this fissure lies can be traced on the south and west sides and if the fragment, thus bounded, should split off, the obelisk would undoubtedly fall.

The conditions are considered serious enough to demand immediate repairs, and a contracting firm is now engaged in the work of preservation with scaffolding erected.

The process to be applied includes the removal of all loose fragments; the heating of the surface of the stone to about 212° F. by portable furnaces and the application of a patented composition in which paraffine is the chief ingredient.

THE death of two more men at Shaft No. 6 on the New Croton Aqueduct on last Sunday morning calls attention to the fact that these fatal accidents are becoming too common in that locality. Within the last six months twenty-six men have been killed outright and twenty-six seriously maimed.

There are now twenty-four shafts open on the work, and we learn that the average of workmen is about 150 to the shaft, or 3,600 men. But the average payroll shows about 300 men for each shaft, so that the casualties must be divided among 7,200 employes of all kinds. While the percentage is thus comparatively small and such loss of life is rather the rule on extensive public works, the record still exceeds that on many others comparatively quite as important and dangerous.

As near as we can learn, the greatest mortality is due to loose rock in the roof of the tunnel; this is a matter that proper care and intelligent testing after a blast can provide against if not actually prevent, and is usually the first care of a competent foreman. The only excuse that can probably be offered is that the work is being pushed to such a degree that sufficient time is not permitted to discover and dislodge the threatening fragments; low prices make rapid progress absolutely necessary to keep expenses inside of revenue, and the workmen must thus suffer for the close competition among contractors.

On much of the work all reasonable precautions seem to be taken for preserving the lives of the men passing up and down the shafts; though in this connection we must say that we nowhere noticed any device for closing the mouth of the shaft when the cage was at the bottom or going down. Although we are not aware of any casuality happening from this omission on the Aqueduct, we have known it to be productive of serious loss of life at other points.

Workmen are proverbially careless and the most experienced among them are frequently the ones to suffer from their recklessness; but this fact makes it only the more imperative upon their employers to use *every* precaution to protect them from all that might endanger life. Under their contract with the city these employers are responsible for all such damage as may result from their neglect, and as long as the general provisions of this contract are complied with the Aqueduct Commission can only suggest improvements, but in no other wise interfere. The last accident was due to a drill striking an unexploded cartridge "missed" in a previous blast; this was inexcusable, and while it is an incident of not unfrequent occurence, it is always directly chargeable to carelessness in examining the results of the last round fired; a close inspection will always tell the story and no sane man will attempt to drill into a dynamite cartridge.

We would advise a little more time devoted to seeing that all is safe; that shaky rock be removed or propped, and that then the progress record be pushed for all it is worth.

American vs. English Railway Practice.

The immediate future promises railroad construction in lands hitherto untouched by the iron horse; and in China especially the long closed doors are even now ajar with a brighter prospect than ever before of being soon thrown wide open to the engineer and contractor. In many other distant fields the experience with trial lines of railroads is proving their great advantages for national development and imperatively calls for an addition to tneir existing mileage.

These being the conditions, it is now high time that the American engineer bestirs himself in reaping from these far-off fields, and every effort should be made, both in the profession and out of it, to demonstrate to the world at large the many advantages to be derived from the adoption of American practice and the employment of American engineers.

England has hitherto mainly supplied the professional market of all climes; but with the true British instinct she has been endeavoring to force her home practice into lands not calculated to derive benefit from its adoption. The local conditions, under which the English engineer has been trained, are peculiar. That nation is entitled to the credit of the first practical railroad and locomotive, and in the lapse of years the system has grown to great perfection in many of its details. But they are to-day still hampered by the crudities of the men who first introduced the system; the stage-body is still the receptacle for travellers; the "guard" still protects the passenger; narrow tunnels and an-

cient depot structures prevent the introduction of more modern and convenient rolling-stock, even if considered advisable, and in many ways their practice has the musty odor of a time and people that have passed away. Their road-bed is perfect, but it is the costly perfection demanded by a dense and exacting population, and in some of its features still smacks of the day when it was thought that a curve of one mile radius was the minimum for the safe passage of trains.

But while the English roads and their equipment may be well adapted to a country situated as is England, are they the best for all lands and all people? We think not. In the first place, railroads are now generally wanted to open up a new country to commerce, and, as the length of line is frequently great and the immediate return comparatively small, a wise economy in first cost combined with efficient service is demanded. From an exceedingly valuable series of papers lately read before the American Society of Civil Engineers, by Edward Bates Dorsey, on "English and American Railroads", we find that, in 1883, the average cost per mile of railways in England was $202,227 as opposed to an average of $62,176 for American lines. But while, from the very expensive and permanent nature of their roads, with straight lines and easy grades, one would naturally look for a corresponding decrease in the operating expenses, Mr. Dorsey's papers, by their statistics, show that this is not the case. This is news to Americans, and as a few of the figures quoted will be instructive, we give them as follows:

1883.	United Kingdom.	United States.
Miles of line operated	18,681	110,414
Total cost per mile	$202,227	$62,176
Total ton mileage (miles)	9,589,786,848	44,064,923,445
Average train load, tons	73	126
Average freight charge, per ton, per mile	$0.02	$0.0124
Total passengers of all classes transported	684,350,187	404,811,584
Average number of passengers transported in each train, per passenger train mile	39.6	45.5
Total passenger mileage	5,494,801,496	8,817,684,503
Average passenger fare all classes per mile	$0.0233	$0.0242
Gross earnings per mile from freight and passenger traffic	$17,249	$7,007
Total operating expenses per mile	$10,003	$4,410
Percentage of gross earnings to total cost	0.0005	0.1099
Percentage of net earnings to total cost	0.0425	0.0449
Percentage of operating expenses to gross receipts	0.54	0.36
Passenger earnings per passenger train mile	$0.925	$1.14
Freight earnings per freight train mile	$1.50	$1.56
Average number of miles a passenger can travel without being killed	177,251,655	
On railroads in New York State, 1884		211,646,410
On railroads of Massachusetts, 1884		503,568,188

As the author well states, the principal, if not the only advantage of expensive over cheap construction is the reduction of the operating expenses; and yet when all items of expense that are in any way affected by good or bad construction have been added together by Mr. Dorsey, and the percentage calculated to the whole operating expenses, it is found that this percentage is 0.5966 on all the American railways as opposed to 0.518 on all the roads of the United Kingdom. The percentage in favor of the latter is thus 0.08. Percentage so calculated will naturally be larger on cheaply constructed roads with sharp curves and steep grades and built with perishable material than on a railway where money has been freely spent to secure opposite conditions.

A comparison of the cost of American and English railways with their operating expenses shows that the English road costs three times as much to build, yet only saves 8 per cent of the annual operating expenses; or as expressed by Mr. Dorsey, if American roads added $140,051 per mile to their cost, so as to equal English construction, they would save 8 per cent. of $4,410, the average operating expenses, or $353; while if English railways had been built on the American cost basis, they would have saved $140,051 per mile on first cost and added 8 per cent., or $800 per mile to their operating expenses. Thus stated the costly construction would certainly *not pay* on the long lines of a new country.

Of American engines and rolling stock little need be said; we are already selling them in English markets, where the demands of the line-location make the heavy English engine with its long rigid wheel-base a type impossible to utilize. The possibilities of American engine construction in difficult country, are well illustrated on the elevated railroads of this city, where they annually haul, without an accident, one hundred million of passengers around curves of much less than 100 feet radius on a standard gauge track.

The conditions of the various foreign lands now estimating on railroad construction are practically much like our own once were; they have same wide and frequently sparsely settled areas, with steep mountain ranges to be climbed and broad rivers to be crossed, that first called into existence and then perfected a system that is emphatically our own. In our case necessity and a comparative poverty of means and material originally made necessary a radical departure from methods then in use in more favored countries; the problem was set before us, and the practical Yankee brain solved it and then went on improving until our engineering works are the proud monuments of the land, and the American engineer has literally done more to lift us to an eminent place among the nations of the earth than any other single profession or class.

But our own rapid progress has created a brood of experienced professional men that now need elbow-room, and that room is to be found wherever economical but efficient construction is needed. If in this article we have selected England alone for comparison with our own practice, it is simply because the aggressive Anglo-Saxon is our chief rival in other lands and to emphasize the fact that we have a professional foeman that will not be budged from the foothold he has already secured without a stubborn fight. It is not sufficient to feel convinced that our practice is better for the countries that now need railroads, but we must convince these countries themselves by every honest, practical means. We must go there with money, engineers and hard facts in our fist; that is the Englishman's method and to his personal energy and aggressive spirit he owes his success rather than to the adaptability of the system he advocates.

Shall England Build Our War Ships?

This question seems again pertinent, in view of a fact reported by the daily press, that Sir N. Burbody, the English Naval Constructor, is in Washington repeating the impudent advice of "The Engineer", referred to in our issue of August 1st., that our naval officers are not sufficiently well trained to build our ships, and that we should have them built in England!

Right here, we remember that in the winter of 1842-3, Sir George Simpson, Governor of Hudson Bay, *happened* to be in Washington, and was dined and wined by Secretary Webster, whom he so impressed with the worthlessness of Oregon, that if it had not been for the energy of the Presbyterian Missionary Whitman, we would have lost *all* of Oregon, and as it was, we lost half of it, and an unbroken Pacific coast line. Our Secretary of the Navy is likewise dining Burbody, and other naval officers who are "not sufficiently well trained," sit round the board to absorb wisdom.

The claim of England, as we intimated last August, seems untenable, at least. All engineers know that most of the improvements in engines are of American origin; and in the matter of the models of vessels, the whole world knows that we have held the cup we took from her in 1851, till now, without having its possession seriously challenged till this year, and then two boats were able and ready to defend it, and one of them did so, without having to make a single alteration, it being well understood that a yacht should have at least one season's trial before racing.

Now when she is being badly beaten by the Belgians in the matter of stationary engines, and we are beating her on locomotives in her own colonies, she procures her agent to come here and and advise us that we "are not sufficiently well trained" with the same trade instinct that induces her to send troops to King Thebaw; her preferences being first, that we should stay as we are in maritime affairs, and if that is not possible that we should build our ships in her yards, or failing in that, that our ships should be built in Government yards for she knows that if our private yards once secured the concentration of capital and skill that would accrue from building the thirty or forty steel cruisers our Navy requires, the superior skill and energy of our mechanics would make us as dangerous competitors in ships as we now are in locomotives, bridges and pumps. It is not convenient to "The Engineer", "Engineering" and the other of our British contemporaries, this frequent beating of the patriotic tom-tom over a matter of twenty or thirty pumps; this having to say: "But we should like to know why the contract was let to an American at all, and why a single penny of the money paid by the British taxpayer should be sent out of the country", interferes sadly with the air of calm superiority they are so fond of assuming, and if that sort of thing continues and has to be extended to a question of ships also, England's opportunities for charging "*a long price*" for her commodities would be decidedly curtailed.

Hence it was with no common pleasure that "Engineering" wrote on July 24 of John Roach's failure, that he was "practically the only man in the United States able to build large iron vessels," and "during the ten years, 1873 to '82, over seventy iron ships were launched from Mr. Roach's yards, twenty-seven of them for foreign trade, with a total tonnage of over 146,000 tons. The closing of his yards means almost literally the cessation of iron ship-building in the United States." We wonder if our contemporary has forgotten that on occasion of a threatened unpleasantness with Russia, Cramp, of Philadelphia, who seems to get a good deal of milk in a still way out of ship building, sold Russia four iron steamers! And this is soon after England's breathless race through the world's markets for ships when fearing difficulty over the Afghan question.

The fact is, there were eight different firms that bid on the cruisers, four firms being prepared to take all of them. Mr. John Roach's failure does not "mean almost literally the cessation of iron ship-building in the United States," nor anything like it.

It is so long since it is has been published, that we print a list of those places where iron ships were built within one year from the commencement of our war, with the conviction that it will not be pleasant reading for those who think that industry can be permanently crushed in this country, viz., Portland, Maine; Boston, and Charleston, Mass.; New York, and Green Point, N. Y.; Jersey City and Kane's Point, N. J.; Philadelphia, Chester, and Pittsburg Pa.; Wilmington, Del.; Norfolk, Va., Charleston, S. C.; Mobile, Ala., New Orleans, La.; Cincinnati, Ohio, and St. Louis, Mo.

He who starts without money but with faith in advertising, soon outstrips the capitalist who does not advertise.

Civil Engineers on Government Civil Work.

The committee of the Civil Engineers' Club of Cleveland appointed last August to consider what action, if any, is advisable "in the matter of obtaining the passage of new laws providing for the better condition of civil engineers employed on government work, other than civil", is drawing its energetic labors to a close. This committee in their desire to bring the subject before the entire profession of American civil engineers issued a series of circulars to the various engineering societies in this country, asking each society to appoint delegates to meet in a general congress and fully discuss this interesting topic.

Eight societies, those of St. Louis, Chicago, Cleveland, St. Paul, Minneapolis, Michigan, Pittsburg and the Southern, have signified their intention of sending representatives; and by general consent, Cleveland, Ohio, has been fixed upon as the place of meeting, and the date is December 3rd, 4th and 5th next.

The chief point to be discussed is expressed in the following paragraph from the circular sent out:

"A few are educated by the Government to take charge of its engineering works, with life positions of trust, emolument and reputation, while a large number who would choose it for their life work, are perhaps equally educated by actual experience of years in the service, and yet have not the rewards granted the few. It is our opinion that some legislation may be obtained which shall bring to this class of engineers, an incentive to even greater ambition and devotion than can develop under the present laws".

The desire of the committee is to arrive at some satisfactory solution of this problem "without in the least antagonizing the military element of our brotherhood." The purpose of the congress is to calmly and intelligently consider the subject in all its manifold bearings, and, if possible, to prepare a memorial that will be acceptable to all concerned. To this end they invite the personal attendance of all interested engineers, or at least an expression of opinion.

In this matter we can say that we are heartily in accord with any movement having for its purpose the improvement of the condition of American engineers; and especially of so deserving a class as those who have done so much good, but generally unrecognized service, on our government work. But just how this end is to be best attained we must confess is beyond our ken, and we shall look with interest for such solution as may be suggested at the coming meeting.

The government of the United States has put its national engineering work into the hands of a body of engineers trained for this especial purpose; and in this matter has followed the practice of other nations, in part, at least. But if the government does not provide professional engineers in numbers sufficient to meet all demands, and this is very apparently the case, we think that the assistants called in from civil life should be properly recognized and provided for. The civil assistants should be raised to a higher plane, as far as continuity of service and rank are concerned, than the man who is hired to manufacture a brush-mattress or drive a bunch of piles. Among these civil assistants the government frequently finds its most useful men, and we say this without reflecting in any manner upon the many able and prominent engineers who are found in the ranks of the official corps; but civil engineers proper are the result of a wise combination of study and practice, guided by intelligence and well-balanced common sense, and a course at a military school is not absolutely essential to this attainment.

The civil engineer who gives his best services and the best years of his life to our national government should be, in some manner, accorded a rank and remuneration to be measured purely by the value of his services, whether he be educated by the government, or be called from civil life on account of his professional experience elsewhere obtained. This is simply an act of justice demanded by the members of a profession that takes high rank in our national economy.

If military discipline is deemed necessary among civil engineers on government work, let the same rules bind all employes; make them as stringent as possible; but let all who are engaged in this service feel that a like career is open to every man in reward for good work and that any reasonable ambition can be gratified. The government will be the gainer in the end.

In making these remarks we appreciate the fact that we are in a manner advocating a condition of professional life that is not usual among American civil engineers, that is, tenure of office lasting for life or good behavior. Their services are of notoriously uncertain tenure, and the engineers as a rule, spend their time between drifting from one job to another, or in waiting for an engagement. It may be said that there is no difference between the action of the government in this case and that of a private corporation when circumstances demand a curtailment of expenses; but there is this very essential difference; with the corporation the engineer has position as well as pay as long as the engagement lasts, while in the government employ the law, at times, makes him subordinate in all things to a young and inexperienced man who rules by virtue of a commission solely. As we regard it, the present demand is for a proper and just recognition of services and a standard of rank fixed by merit combined with length of faithful service; and in this demand upon our law makers we are confident that the civil assistant will have the support and good will of the best and most experienced among the trained engineers of the government corps.

The Utilization of the Sewage of Paris.

The French government in June, 1885, received a report from a commission charged with the examination of a project for utilizing the sewage of Paris in agriculture. Dr. Bourneville of this commission made an interesting and voluminous report, and of this *Le Genie Civil*, of October 17, gives the following short resumé:

The system of sewers of Paris is about 434 miles in length; this system absorbs the rain-water (about 80,000 to 100,000 cubic metres gathered from the surface of the city), and the waste from the public lavatories and domestic and industrial establishments, and also a portion of the material from cess-pools. The author calculates that each man daily produces 2.64 pounds of waste matter, of which 2.57 pounds is liquid. For the entire population of Paris this would amount to about 2,860 tons, of which 2,655 tons are liquid and 204 tons only are solids. The fermentable portion, that which at times produces infection and includes matter that is of productive value as manure, is almost entirely confined to the liquid portions; as he figures 58,953 pounds of azote as the daily product of all Paris, and of this only 6,644 pounds is found in the solids.

At present four systems are actually in use for the reception of this unclean matter: the fixed well; the movable well or tub; the filtering tub and its direct discharge into the sewers. The disadvantages of the first two methods are well known. The third is a new system introduced within the last 15 years into Paris, and there are now 27,000 of these *tinettes filtres* in the city, utilized by 500,000 inhabitants. This appliance permits a liberal use of water and has advantages over the wells but is unsatisfactory as compared with direct water carriage in the sewers.

Water carriage means the immediate removal of all unclean matter in a sufficient cube of water for its transportation, before any fermentation has set in; it is employed in all the great cities of Europe, but is of very recent introduction into Paris, but now the sewers receive a very considerable portion of this material.

The infection of the River Seine which has resulted from this new departure is already assuming serious proportions, and at the bridge of Asnières, where the great Clichy sewer empties on the right bank, the Seine is a veritable open cess-pool. The water is discolored and covered with a greasy scum; the azote reaches 25 grammes per cubic metre; the oxygen has almost completely disappeared (1 c. c. per litre), being absorbed by the organic matter and rapid decomposition, and the *number of microbes is* 200,000 *per cubic centimetre.*

The two great collectors of the right and left banks uniting at Clichy, furnish, according to the latest gauging in 1884, a daily cube of about 11,152,441 cubic feet, (315,936 cubic metres), or 115,627,738 cubic metres (4,080,659,151 c. feet) per year.

As the mean of eighteen years observation the waters of the Clichy collectors contain the following proportions of various elements per cubic metre:—

		Kilogr.	Kilogr
Volatile and Combustible Matter.	Azote	0.041	0.815
	Other products	0.774	
Mineral Matter	Phosphoric acid	0.017	
	Potash	0.031	
	Lime	0.351	
	Insoluble residue in the acids	0.704	
	Various products	0.630	1.733
	Total		2.548

Dr. Bourneville then briefly discusses the various systems of mechanical and chemical utilization of sewage, and concludes that its absorption by the soil and agricultural application, as used at Gennevilliers for the past fifteen years, is the best; and he proposes the extension of this system to the provincial lands of Acheres, including 1,200 hectares of area. Taken in connection with land now under cultivation at Gennevilliers this would give a total of 2,200 hectares; with this area it would be necessary to purify and utilize about 59,000 cubic metres of fluid per hectare. But neighboring plains offer 4,500 hectares of irrigable soil and can be utilized. In answer to objections advanced against the Gennevilliers system he says, that during the coldest season the waters in the sewers preserve a temperature of 5° to 7° above zero, centigrade; that continuous irrigation has been proven to be possible; that the soil he proposes to add is permeable, and that the present experiment is not an infectious morass, as some claim.

Drainage in Illinois,

The great drainage canal now being excavated in Piatt County, Illinois, consists of a main channel, 11 miles long, extending from the south east part of Piatt County into Moultrie County, with numerous branches now being surveyed. The main stem is nearly completed. The contractors are Pollard, Goff, & Co., of Peoria, Ill. The material is excavated by a boom dredge, which is carried on a boat 70 feet long and 30 feet wide. The ditch is from 8 to 20 feet deep, and is 40 feet wide in the shallowest places. The price paid is 11.9 cents per cubic yard, with a bonus of 1.6 cents per yard if completed before April 1st, 1886. It is intended to ultimately extend the ditch from Crane's Bridge, a little north of Atwood, a station on the I. D. & S. R. R., the end of present contract, to the Sangamon river, some 10 or 12 miles more. There is considerable complaint of the present commissioners, and consequently opposition to a further extension. A new board will be elected in November.

It has been estimated that there are 20 miles of these drainage canals in Champaign

county, either constructed or immediately contemplated. There are one or two very large schemes on foot in Kankakee County. It is also estimated that within five years there will be 500 miles of such ditches in the state of Illinois.

Messrs. McGillis & Co., contractors, of Ivesdale, Champaign County, Ill., have just bought a new $28,000 dredge, to operate in a 13 mile ditch a few miles east of the one above described. With the exception of the two above noticed and one other, the drainage canals or ditches in Illinois have been excavated by hand scrapers and shovels.

Work of this character is done under the drainage law of the State, which provides for an assessment upon the property benefited; and is under the charge of three Drainage Commissioners, elected by the residents of the district benefited.

PERSONAL.

CHARLER E. WEBSTER, late Resident Engineer of sub-division D of the South Pennsylvania R. R., is now engineer with Brown, Howard & Co, Contractors on the New Croton Aqueduct.

CORRECTION.—In reporting the names of the names of the officers and directors of the "Technical Society of New York," it was erroneously stated MR. GEO. W. WUNDRAM'S address was "*Board* of City Works, Brooklyn." instead "*Department* of City Works, Brooklyn,"

THIS week a number of changes in the official staff of the operating department of the Pennsylvania Railroad takes effect. They are as follows: George W. Creighton, appointed assistant engineer of the West Jersey and Camden and Atlantic Railroads, with headquarters in Camden; F. P. Abercrombie, assistant engineer of the Sunbury and Shamokin Divisions of the Northern Central Railway, vice George W. Creighton; G. L. Cummins, supervisor of Division No. 1, Philadelphia Division, vice J. Craig, deceased; S. C. Long, supervisor of Division No. 3, Philadelphia Division, vice G. A. Starkweather, transferred; J. S. Nichols, supervisor of Division No. 16, Monongahela Division, vice S. C. Long, transferred; G. A. Starkweather, supervisor Division No. 21, Tyrone Division, vice G. L. Cummins, transferred, and J. H. Murphy, supervisor of Division No. 26, Frederick Division, vice J. S. Nichols, transferred.

MR. WM. M. DOUGLAS, of the United States engineer's office, in this city, has prepared his plans and specifications for the improvement of the Rio Grande de Sul harbor in Brazil. The charts are very neat works of engineering skill, and the specifications full and explicit. These papers will be forwarded for competition in a few days, and as MR. DOUGLAS is in competition in this work with some of the most skilled engineers, it will be quite a compliment to his ability should his plans meet with favorable consideration.—*Galveston News.*

American Society of Civil Engineers.

A meeting of the Society was held on Wednesday evening last. Among the business transacted were resolutions looking towards the increase of the Junior membership of the Society and a more general invitation to the meetings of persons interested in engineering topics. The paper of the evening was read by Mr. F. Collingwood, on the "Behavior of Cement Mortars under various Contingencies of Use."

The following gentlemen were declared elected as members of the Society:

FOR MEMBERS.—*Edward Sherman Gould*, formerly Civil Assistant Engineer, Corps of engineers, U, S. A., recently Assistant Engineer, Bronx River Water Supply, Department of Public Works, New York City: now Division Engineer New Croton Aqueduct, Yonkers, New York: *Benjamin Dwight Greene*, formerly with Corps of Engineers, U. S. A.; also upon Improvement of Mississippi River, and upon Harbors on South Atlantic Coast; now General Engineer and Contractor, Oswego, N. Y. *Simpson Clark Heald*, formerly Chief Engineer South Abington, Mass., Water Works; now in charge of sewerage for Turner's Falls, Massachusetts: *Thomas Franklin Richardson*, formerly Division Engineer Atlantic and Pacific R. R., now Assistant Engineer Mexican Central Railway, El Paso, Texas.

Engineer's Club of Philadelphia.

The first regular meeting of the season was held on October 17th, in the New House of the Society, 1122 Girard street, with sixty-two members and four visitors present. Mr. P. F. Brendlinger presented an illustrated description of a cheap and novel Cement Testing Machine: Mr. John T. Boyd described the "Coventry" locomotive boiler, the latest novelty in that direction, and Walter C. Brooke presented, through the Secretary, a description of appliances for Landing Mine Cars at the Top of Slope. The Secretary reported, that after a determined struggle and the untangling of much red-tape, the Club is now officially entitled to entry duty free of certain books presented by the British Government.

International Institute.

The next Annual Meeting of the International Institute for Preserving and Perfecting Anglo-Saxon Weights and Measures, will be held in room 21, Cooper Union, corner 8th street and 4th avenue, New York, for the election of officers and the transaction of such other business as may come before the Institute. First session on November 10th, 10 A. M.

In addition to the papers mentioned in the programme, others are expected.

Mr. Edward L. Wilson, one of our members, who has visited the Pyramids of Egypt, the Holy Land, and the famous ruins of Petra, and taken upon the spot views of the grandest monuments of those countries, has kindly offered to exhibit them before the Institute with his oxy-hydrogen light. This exhibition will be of extreme interest. A description of the scenes visited will be given, and the points specially touching the Great Pyramid of Jeezeh will be discussed.

The public cordially invited to all meetings. Tickets to the exhibition at Chickering Hall, at 8 P. M., November 10th, will be furnished free on application to Mr. J. N. Wing, 743 Broadway, New York.

Members, with their friends, will dine together November 11th.

CHARLES LATIMER, *President*,
Cleveland, Ohio.

Increase in Danger from Lightning.

THE *Zeitschrift fur Electrotechnik* calls attention to the fact that though about 130 years have elapsed since the original introduction of lightning-rods, comparatively few buildings are provided with them in Europe.

Prof. G. Karster, calculates that the yearly destruction chargeable to lightning would reach the sum of from $1,500,000 to $2,000,000, Prof. Holtz has prepared statistics showing that out of one million buildings insured againt fire there are 200 struck by lightning each year, and that in the case of churches, the proportion would be 5,000, or even reaching 10,000 in some localities.

But investigations lately made, show that in the last fifteen years there has been a decided increase in danger from this source from some yet unexplained cause. In 1869, Prof. Von Bezold published the results of his investigations based on the returns of the Bavarian Fire Insurance books, in which 90 per cent. of all existing buildings in that country are insured. This report showed a regular increase in the number of buildings struck by lightning; and investigations made in 1884 show that in Bavaria this increase has been threefold since 1869.

Similar investigations made in Saxony, show that from 1864 to 1870, the buildings struck numbered 151 per million per year; while in 1879-1882 the returns gave 271 per million annually. In Prussian Saxony comparison made between the decades 1864-1873 and 1874-1883 shows that the danger has doubled.

In attempting to investigate the cause of this increase, many theories have been advanced. An increased number and severity of thunder-storms, was first looked for, while others charged it to some changed condition of buildings, and the greater use of metal in construction, in gas and water-pipes, etc. Prof. Von Bezold holds that in Bavaria both the number and intensity of thunder storms has increased, and he regards the newer modes of construction as of secondary influence.

Prof. Holtz, however, fails to find any proof as to the increase of storms, and shows by statistics that in Germany the largest number of strokes are recorded exactly where the most metal is used in construction. Thus the doctors disagree, and the discussion is still open.

Explosions of Carbon Dust.

M. C. Engler has been making some experiments on the nature of explosions caused by various kinds of dust, more especially in connection with accidents which have occurred in the manufacture of lampblack. He finds that these explosions may be attributed to the inflammation of a mixture of combustible gases and air, of carbon in a finely-divided state, or of a mixture of combustible gases and particles of lampblack in air. The problem which he set himself to solve was this: Is it possible for the inflammation of dust floating about in the air to take the form of an explosion, even when this dust is incapable of engendering a combustible gas under the influence of heat? It is scarcely necessary to follow the details of the experiments, but as the conditions of one series were those in which a combustible dust and an inflammable gas were brought in contact with each other—circumstances which have been found to give rise to spontaneous combustion of a more or less explosive kind—some particulars in regard to them may be given. The first materials selected were charcoal dust and ordinary illuminating gas, and it was found that air mixed with from 8 to 12.3 per cent. of gas and dust exploded on ignition. When the mixture was from 3.5 to 7 volumes per cent. the whole mass rapidly took fire, but when there were only 2.4 volumes per cent. the mixture did not ignite. According to Herr Wagner, air charged with Munich gas to the extent of 6.7 volumes per cent. will, on ignition, cause slight explosions; but air which contains only 6.25 per cent. of gas is not susceptible of ignition. With Carlsruhe gas (with which the experiments were made) it was found to be impossible to cause the inflammation of mixtures of air containing less than 7.5 per cent. of gas. It seems, therefore, that a mixture of air and lighting gas (where the latter exists in too small a quantity to allow of its inflammation) becomes capable, whenever it contains, in addition, particles of carbon in suspension, not only to quickly propagate flame, but to produce actual explosions. The experiments of M. Engler possess especial interest, inasmuch as they show that a carbon which does not develop combustible gases under the influence of a high temperature (as, for instance, charcoal) is nevertheless capable of redering explosive a mixture of air and hydrocarbon gas when the proportion of the latter would, under any ordinary circumstances, be sufficient to engender flame.

WATER

SKOWHEGAN, MAINE, will introduce the electric light.

MAINS for the new water-works are being laid at St. Clair, Mich.

ELKLAND, TIOGA COUNTY, PA., will probably be lighted with natural gas.

TEXARKANA, TEXAS, will issue $30,000 of bonds for the immediate construction of water-works.

A WATER company has been organized at Woodsville, N. H., with a capital of $27,000.

NEBRASKA CITY, NEB., cries out for clarified Missouri river water.

KINGSTON, PLYMOUTH CO., MASS., has voted 264 to 128 in favor of a water supply.

B. M. TEMPLE, C. E. of the Gulf, Colorado & Santa Fe railway, has been engaged by the City Council of Navasota, TEX., to lay out a system of drainage.

PARTIES in search of capital for the construction of water-works, will be interested in an advertisement on another page.

THE Norwood Gas Company, of Norwood, has been incorporated, with George H. Morrill as president and Edmund J. Shattuck as treasurer. The capital stock is $12,000.

THE work of putting a filter in the river for the water company at Pittston, Pa., had to be suspended for a few days recently, owing to the high state of the water in the river.

CRAWFORDSVILLE, IND., (population 6,000) has twice advertised for bids for building water-works, and twice rejected the few bids offered as unsatisfactory. This state of affairs is due largely to indefinite specifications.

THE Western Electric Light Co. of Chicago have just begun the erection of an electric light plant for Champaign and Urbana, Ill. They will start with 25 lights for private consumers, with a probable increase to 40 or 45 soon after starting.

LA CROSSE *Republican*: The number of gallons of water pumped for the city every day, registers 1,580,000, but this must be discounted about one third, because the pumps do not completely fill the pipes with water, and the quantity registers from revolutions, and not from actual measurement.

BOSTON, Oct. 30.—In the Supreme Court, to-day, the jury returned a verdict of $14,630 for plaintiff in case of Charles Linnehan vs. the city of Boston, which was an action to recover $31,800 for work performed in building the Moon Island sewer.

FAIRBANKS MORSE & Co., of Chicago, have completed the Beloit Wis., water-works. At the test on last Saturday five streams were thrown 128 feet high. The contract for pipe-laying was awarded to C. E. Gray, Jr., of St. Louis. Total cost of works about $90,000. Mr. J. R. Kinley, of Chicago, was Constructing Engineer. The works are owned by the Beloit Water Company.

EL DORADO, KAN., Oct. 31.—Arrangements have been completed for a system of water-works, and four main pipes will be put in this fall.

Contracts for supplying the city with gas have also been made. The street railway company will put down a mile of track this season and have street cars running before Christmas.

HINGHAM, MASS., October 29th.—The Hingham Water Company has contracted with Messrs. Goodhue & Birnie to lay about four miles of 10 and 12-inch pipes to connect with the 14-inch main leading from Accord pond. The estimated cost of the improvement, including land damage, is $40,000, and the company, at a meeting recently held, voted to bond to that amount.

GENERAL ALEXANDER VARSELOVITCH BARMINSKY, Imperial Engineer of the Russian army, is on a brief visit to Boston. St. Petersburg has no system of public water supply, and the General is inspecting the water-works and improved sewerage system of Boston. The General's visit to America is for the purpose of examining lighthouses, dry-docks, canals elevators, harbor fortifications, etc.

THE hydraulic company have cleared off a site for a new reservoir above the present one. This reservoir will add about twenty-five feet to the fall, and the volume of water will be considerably increased. The company also talk of putting in new street mains of 6 inch iron, and if this is done Bayfield will have water-works second to no other town or city in the northwest.—*Lake Superior News.*

WATER SUPPLY IN RENSSELAER COUNTY.—Engineer Worthen of the water commission visited several lakes in the Sandlake region, Oct. 29. Mr. Worthen finds that the elevation of Hastings' pond was sufficient to bring the water into Snyder's lake. Then by a half mile of tunnelling the water could be brought to Tierken creek, which empties into the river at Greenbush. The project of obtaining water from this source is considered feasible by many.—Albany *Evening Journal.*

THE Hastings, Neb., water-works well will be 11 feet deep and twenty-five feet in diameter.

ATHOL, MASS., has voted to put up all the street lights asked for. Col. Waring has submitted a plan of a system of sewerage to empty the refuse matters into Miller's river.

ROCKLAND, ME., November 5.—At noon to-day water reached this city through the pipes of the Camden and Rockland Water Company from Oyster River pond. The works were built to compete with the Rockland Water Company, which had a monopoly for thirty years. The water was brought seven miles.

GREENFIELD, MASS.—An attempt was made at the last session of the grand jury to indict the town on account of allowing the sewage in the vicinity of Russell street, to contaminate a small brook which runs down the ravine in the town of Deerfield. Having had this narrow escape, the selectmen will ask the town to build a new sewer, which will connect with the main sewer that empties into Green river.

MARSHALL, MO., October 27th.—At a meeting of the City Council last evening, the water-works, which were recently constructed in this city by the National Water-works Company, were accepted by a unanimous vote. A vote of thanks was tendered Maj. Pen. F. Jones, Superintendent of the company at Kansas City, and G. W. & R. C. Pearsons for the able manner in which the works were constructed.

THE Council of St. Gabriel Village, near Montreal, has decided, at the request of the municipal board of health, to extend their sewer system through St. Andrew, St. Albert and St. Charles streets. Mr. W. McLea Walbank, C. E., the engineer of the St. Gabriel council, was notified to prepare the plans and specifications and send out circulars inviting tenders. In forty-eight hours the plans, etc., were prepared and the council in possession of tenders for the work. The sewers, which are to be egg-shaped and of brick, will be 3 feet high by 2

HINDS, MOFFETT & Co., of Watertown, N. Y., have completed the Homer, N. Y., Water-Works. Work was begun July 20th, and on October 24th the pumps were started. The company rent 30 hydrants to the town at $50 dollars each per year. Water is pumped to a reservoir by a Worthington Duplex engine The pipe is cast-iron, the valves and hydrants of Ludlow Manufacturing Co.'s make. Hinds, Moffett & Co. have put in 11 water works this year, and have nine contracts ahead for next year.

THE Muncie, Ind., water-works are in operation. Work was commenced in May, and successful tests were made in September by Mr. J. D. Cook, and Mr. W. Royce. There are over 8 miles of pipe, and the city agrees to pay $5,000 a year for 85 hydrants on 7 miles of pipe, ranging from 4-inch to 12-inch diameter, with a pumping plant of 2,000,000 gallons daily capacity, and a pressure of 130 pounds. The pumps are located on White River above the city, where a park is to be laid out, and a large settling basin built. The works were built under the management of Mr. W. S. Kuhn, and S. M. Highlands is superintendent.

HARTFORD, CON. Nov. 4.—An erroneous item has been going through the press to the effect that the Connecticut Mutual has sued the city of Evansville, Ind., for defaulted interest upon $3,000,000 bonds of that city, issued for the purpose of building water works, on which it is stated no interest has ever been paid. The bonds were issued in 1870, and are for only $200,000 in amount, and interest was paid promptly and without any question until July, 1883. The bonds are a direct obligation of the city, which has attempted to force a compromise on interest by threatening repudiation. The company has brought suit to enforce its claim.

THE report of Dr. Rauch at the quarterly meeting of the Illinois Board of Health, Oct. 29, refers to Chicago's water-supply as follows:

A systematic observation of the varying character of the water-supply of Chicago was begun early in September. The chemical examinations by Prof. Long are made weekly, and, coupled with the meterological conditions, recorded and furnished by the United States Signal Service for this purpose, will result in a scientific determination of the relation of the purity of the the water supply the movement of the sewage-contents of the Chicago River.

With the completion of the Ogden-ditch dam and the exclusion of the Desplaines River from the South Branch, such determinations as those obtained Sept. 19 should be the rule and not the exception. The water that date is seen to have been excellent. It is to be understood, of course, that the exclusion of the Desplaines is to be followed by the continuous pumping of 50,000 cubic feet per minute from the South Branch into the canal.

This amount of water, it is assorted, is the full capacity of the pumps, and not 60,000 cubic feet per minute, as contracted for. If this is so, no time should be lost in remedying the defect, in view of possible contingencies next year. The removal of this 50 000 cubic feet per minute, as a minimum, is essential to the purity of the water-supply, and consequently to the health of Chicago.—Chicago *Tribune.*

TERRE HAUTE, IND., October 27th.—The City Council, to-night, at a special meeting, by a vote of seven to five, awarded the contract for lighting the city for the next three years, to the Electric Light Company. The city is at present lighted with gas. The bids of the Gas and Electric Companies were made low by the sharpness of the contest.

AN item concerning a remarkable artesian well in Tunis has been going the rounds of the press. The figures given are ascribed to Ferdinand de Lesseps and stand as follows: A well-boring-sunk 91 metres deep on the banks of the Lake Melah, struck a subterranean sheet of water which issued with such violence that it lifted stones, "weighing 24 pounds, high into the air," etc. "The well yields 8,000 cubic metres of water per minute." There has evidently been some error of computation or of type-setting here, as this quantity figures up rather rapidly, and the well yieding it would be a "gusher" indeed, at the rate of about 127 millions of gallons *per hour*, one well like that would be enough to supply a dozen New Yorks, even if larger than the present one.

HENRY R. WORTHINGTON'S St. Louis branch, represented by J. R. Williams, has made a sale to the Crystal Plate Glass Co.'s works at Crystal City, Mo., of pumping engines to elevate 6,000,000 gallons of water per day from the Mississippi river to the works, a distance of about 1,500 feet. This house also made a sale of an 800,000-gallon capacity per day special boiler feed pump, fitted with the Worthington pressure regulator to the Union Steel Co., of Chicago; also a 75,000-gallon capacity per day special fire pump, fitted out complete with the Worthington pressure regulator and safety drain attachment with a complete outfit of hydrants, etc., to equip an independent fire protection for the large works of the Indianapolis Malleable Iron Co., at Indianapolis, Ind.—*Age of Steel.*

THE village of Smith's Falls, Ont., is to be lighted with electricity. A company composed of leading citizens has been incorporated, and the contractor is now at work. Smith's Falls is a village of 2,500 inhabitants, centrally situated between Lake Ontario at Kingston, the St. Lawrence at Brockville, and the Ottawa at Ottawa City. It is connected by canal and railway with these points, and also by telegraph and telephonic communication, with the world at large. It is an enterprising manufacturing village. The air line railroad from Toronto to Montreal crosses at this point, and President Stephen of the Canadian Pacific R.R., is now endeavoring to raise the funds for building the line between Smith's Falls and Montreal, the Toronto division being already completed. The next move will be for water-works, and as a supply from the Rideau Lake is easily obtainable there are no great physical obstacles to overcome. If the citizens can be persuaded of its value the main difficulty is out of the way. It is worth a trial by some of our enterprising contractors, as it opens the way to further contracts.

IN conformity with the requirements of section 2, chapter 490, Laws of 1883, of the State of New York, public notice is hereby given to all persons interested, that full opportunity will be afforded them to be heard in relation to the various plans now under consideration by the Aqueduct Commissioners for the location and construction of one or more of the following dams and reservoirs upon the Croton river, in the county of Westchester, viz:

First.—That known as "Quaker Bridge Dam," and reservoir, about four miles below the present Croton Dam

Second.—That as known as the "Muscoot Dam" and reservoir, at Muscoot mountain, about six miles above the present Croton Dam.

Third.—A dam and reservoir on the east branch of the Croton river, and commonly known as the "Sodom Dam and Reservoir 1."

All as shown upon the plans, maps and profiles in this office.

The said public hearing having been adjourned on the 12th of April, 1884, until further notice, will now be resumed at the office of the Aqueduct Commissioners, Room 209, Stewart Building, No. 280 Broadway, in the City of New York, on Wednesday, Nov. 4, 1885, at 3 o.clock P. M., and continued on such days thereafter to which said hearing may be adjourned, until finally concluded.

A WATER-WORKS EPIDEMIC.—We hear frequently of certain diseases as being rife in certain localities. It is worth while to note the existence of an epidemic of a pleasanter character, which just now appears to be prevalent all over the country. We refer to the establishment of water-works, now under way or talked of, in hundreds of (in some instances even small) towns.

Sanitary science teaches the intimate relation which the water we consume, has to the public health under any given circumstances. But when it is considered that so many towns are rapidly outgrowing village or hamlet proportions: that in time large numbers of families find themselves elbowing each other on adjacent 25 or 50-foot lots, often bringing wells and cesspools into perilous nearness to each other; then it is that the need of water and sewage improvements is forced upon the attention of the more thoughtful and enterprising citizens, and practical steps are taken toward accomplishment of the desired results.

Fortunately, the hydraulic engineer of the period is with us in our need. Fortunately, also, the conservative and pull-back-if-you-can sentiment does not control the greater number of American communities. As a result we find an unprecedented activity in the establishment of village water-works all over the country present and prospective, with promise of even greater activity in the future, as public attention is directed to the subject. All of which the machine trade truly appreciates.—*American Machinist.*

NEWS OF THE WEEK.

Contracting.

Court House Contract.—M. D. Britts of Eufala, Ala., will build the new Court-House at Lexington, Ga.

Leavenworth, Kansas.—Geo. Wells, superintending architect of the new public building at Leavenworth, Kansas, suspended some time ago, has been reinstated.

Cincinnati Streets.—Bids will be received until November 25th, by the Board of Public Works, Cincinnati, O., for grading and paving streets.

Steam and Gas-Fitting.—The Docks Department will receive bids until November 11th, for plumbing, gas-fitting, and steam heating for or building on Pier A, North River.

San Antonio, Tex., OCTOBER 27.—Bids for the building of the new joint city and coun y hospital were opened to-day at noon. The successful bidders were Messrs. Niggli & Witte, whose estimate amounted to $33,670.

Lima, S. A., OCTOBER 27.—Permission has been granted merchants to lay down piping from the nitrate deposits at Negreiros and Huarez to the coast, in order to bring nitrate in a dissolved state to the coast and evaporate it there on arrival.

Galveston Harbor.—Plans for a deep-water harbor at Galveston, Tex., were submitted to the council of that city on the 27th ult., and discussed informally.

R. R. Contract.—The F. R. & N. Company have closed a contract with Mr. Baker to grade, tie and iron their entire roadway from the Withlacoochee river to Plant City, Florida.

FitchburgR. R.—Work has begun in blasting out the ledge near Cheapside, Greenfield, Mass., for the double track of the Fitchburg road, which will be ready by the time the new bridge is built.

Ditch Contractors.—The drainage commissioners of Big Slough drainage district, Rantoul, Ill., are soon to let the work of excavating a large ditch 12 to 14 miles long.

Canada in the U. S.—The following among other patents have recently been granted by the United States to citizens of Canada: William Corbitt, Smith's Falls, grave vault; P. W. Strong, of Brockville, magazine fire arm; John Dettrick, Smith's Falls, fire escape; D. R. Nichols, Brockville, rod and bolt cutter.

A New Gun Carriage.—BOSTON, October 29th.—The Powlett pneumatic gun carriage was subjected to a private test here to-day, which was in every way successful. This carriage was invented by Lieut. Powlett, United States Army, who was formerly an English ordnance officer. Lieut. Powlett died at the Massachusetts Hospital in June last, only a few days after his arrival in Boston to superintend the construction of the mechanism. Under the present system from thirteen to thirty men are required to man each gun, while only two men are needed with this arrangement. After the tests the carriage was prepared for shipment to Sandy Hook, where it will be tested on November 15th before Secretary Endicott and the Fortifications Board.

Bridges.—Proposals received for Wrought-iron Swing Bridges, on the O & E. Canal Chillicothe, Ohio.

Oct. 10, 1885. Bridge at Fourth Street.

The King Iron Bridge Co., Cleveland, O., King Co's plan	1425
The King Iron Bridge Co., Cleveland, O., City Engineer's plan	1475
The Wrought-iron Bridge Company, Canton, O., City Engineer' splan	1450
The Mt. Vernon Bridge Company, Mt. Vernon, O., City Engineer's plan	1425
The Smith Bridge Company, Toledo, O. City Engineer's plan	1398

Contract awarded to the Smith Bridge Company.

Oct. 24th, 1885, Bridge at Water and Mulberry Streets.

The Wrought-iron Bridge Company, Canton, O., City Engineer's plan	1350
The Smith Bridge Company, Toledo, O., City Engineer's plan	1190
The Mt. Vernon Bridge Company, Mt. Vernon, O., City Engineer's plan	1160

Contract awarded to the Mt. Vernon Bridge Co.

Railroad Contract.—Messrs. Wheaton, Clark and Trites, have been awarded the contract for the Buctouche & Moncton, N. B., Railroad. Work commenced at Buctouche on Thursday, October 29th.

Industrial School.—Bids have been opened by the Acting Commissioner and Superintendent Oberly, for the erection of an Indian Industrial School at Grand Junction, Col. The bids ranged from $11,500 for brick to $16,000 for stone. It is thought that a suitable stone building can be put up for $14,000.

The Pittsburgh, Cincinnati & St. Louis Railroad has recently received from the Industrial Works of Bay City, Mich., a large pile-driver, which is now at work on the bridge across the Wabash at Logansport, Ind. It consumes a total of 4½ minutes only, in placing and driving a 35-foot pile. The same road has also purchased from the same works two 15-ton wrecking cars.

Levee.—S. L. James and John McGinty have been tendered by the Louisiana Board of State Engineers the contract for the construction of the hole-in-the-wall levee, under Act No. 85 of 1884. The levee referred to is in Concordia parish, will have a length of 3.644 feet with an average height of 6¼ feet; approximate contents about 21,000 cubic yards.

Stone Contract.—The Rockport, Mass., companies have secured the contract to furnish stone for the break-water at that place and as their bid was below the official estimate it is probable that a larger amount of stone will be furnished. The work will be begun November 9, and the stone will be delivered by dropping a whole load at once. This will be done by a flat boat.

Loss of a Dredge.—The boiler of steam dredge No. 4, of the Atlantic Dredging Company, Brooklyn, exploded on the night of Nov. 1, and the dredge sank immediately. Six lives were lost. The boat has been stationed on the Providence River for four years and was on its way to New York in tow of a tug, to work on the Hell Gate debris, when the accident occured.

The Boston Construction Company, which has undertaken the building of a railroad from Cincinnati to Charleston, will do nothing in South Carolina this winter, as their contracts at Shelby and Rutherford, N. C., will compel a concentration of the capital and forces of the company to complete within eighteen months the forty miles section between Rutherfordton and the South Carolina line. They must finish their contracts before they work in South Carolina.

New Company.—Messrs. John Dettrick, F. B. Allan, T. A. Allan, and R. C. Drummond, of Perth, and H. O'Hara of Toronto, gave notice of application for a charter to organize a company to manufacture the Dettrick fire escape, invented by Mr. John Dettrick. The capital stock is to be $20,000 in 400 shares of $50 each, and the chief place of business of the company to be at Perth, Ont.

Smith's Falls, Ont. Electric Light Co.—Last week's Ontario *Gazette* contains the requisite notice respecting this company. The directors have closed a contract for a 30 light machine with Ahern & Soper of Ottawa, agents for the United States Electric Lighting system. This is to be introduced at once. To accommodate the dynamo a station is now being built on Jason Island, water power having been leased by A. Foster, Esq. Owing to the cheapness of the light, the utmost capacity of the company will be taken up.—Smith's Falls *Independent.*

Asphalt Paving.—The singular statement was made to me the other day that there are double the number of miles of asphalt paving in use in the cities of this country than there are in all the cities of Europe, which has been considered as the home of asphalt paving. The figures to demonstrate this fact were shown me by Mr. Barber, of Washington, who was just about starting for London, which he will make his headquarters in a series of bids for asphalt paving in that city, Paris Berlin and others of the great cities, as they determine to lay paving of this sort. He told me also that his company had sent an expert to Europe on whose report they were confident that they could underbid any foreign contractors on their own ground.—*N. Y. Tribune.*

Pipe-Makers.—The pipe makers are very busy. There are between three and four hundred miles of natural gas pipe in western Pennsylvania, and it is stated that between two and three hundred miles more will be laid as fast as possible. It will be just as correct to say that there will be four hundred miles laid as two hundred. Natural gas pipe-laying is only in its infancy. Wells are being bored in many directions not announced by newspapers. No doubt an immense demand will spring up for pipe, and that long lines will be laid from the present end newly discovered regions to remote points. A scheme to carry gas to Philadelphia and New York, while smacking of improbability, is not so wild as may be supposed, but it is more probable that the manufacturing and domestic requirements of the section of the country within one to two hundred miles of the supply will be fully met before timid capital will risk itself in such enormous enterprises as has been suggested.—*Railway Review.*

Stettin Cement.—Mr. Erskine W. Fisher, formerly of London, England, has accepted the agency in this country for the sale of the Stettin, German, Portland Cement. It has been used exclusively by the German military authorities and is said to possess very superior qualities. Mr. Fisher has sold upwards of 8,000 barrels in two months which shows, that for a new cement, it is regarded as a good article. A recent test made by a prominent engineer gives the following results:

Tensile strength, mixed neat in twenty-four hours, 261 pounds per square inch. Tensile strength, mixed neat in seven days, 339 pounds per square inch. Tensile strength, mixed two parts sand and one part cement in seven days, 156 pounds per square inch. Tensile strength, mixed two parts sand and one part cement in thirty days, 233 pounds per square inch.

In this, the important sand test is high. The Stettin Cement, considering its good qualities, is sold at a low figure.

Providence, R. I., Concrete Sidewalks.—Said sidewalks for their whole length shall be of present width, three-eighths of an inch rise per foot from the inside of the curb to the street line, except modification necessary to meet the occupation line, and shall be otherwise constructed in manner and of materials as follows, viz.:

All material above said grade shall be excavated and removed. Good sand and gravel shall be used for filling whenever it may be required.

The foundation shall be composed of clean, coarse gravel, properly coated with tar, and shall not be less than two inches in depth, after being rolled and thoroughly compacted.

The top of the foundation shall be brought to a smooth surface by the addition of fine pebble, completely coated with tar and thoroughly rolled.

The top dress shall consist of clean, sharp sand, thoroughly saturated with tar, and applied in a layer of such thickness that, after being rolled and compacted, it will not be less than an inch in depth. The total depth of walk when finished shall not be less than three inches.

The quality of the tar used shall be equal in all respects to that made by the Providence Gas Company. The gravel and sand shall be thoroughly dry before coating or saturating the same with tar.

Railroads, Bridges and Canals.

The Milwaukee, Menominee Falls & Western Railway Company have filed articles of association with the Secretary of State. Capital stock $1,200,000.

The Indianapolis, Bloomington & Western R. R. will lay 1,000 tons of steel this month on their Peoria division.

R. R. Contract.—James A. Andrews, of Florence, Ala., has taken a contract to build a portion of the Birmingham & Sheffield Railroad, and will begin work in a very short time.

New Bridge.—The highway commissioners, of whom E. W. Vause, Mattoon, Ills., is chairman, are discussing the advisability of erecting a 60-foot iron truss with stone abutments, to take the place of one washed out a year ago.

The University of Illinois has just issued a circular announcing a course in Mining Engineering. Prof. Theo. B. Comstock, formerly of Cornell University, and later mine superintendent, and mill owner in Colorado, is in charge.

Railroad.—It is stated that Col. Hervey, the contractor for the Sheffield railroad, has let twenty-nine miles of the road for construction, from Sheffield toward the mountains, and is also having repairs made on the part of the track heretofore laid.—Chattanooga *Times.*

The Chicago, Rock Island and Pacific Railroad Company has finally decided to build an extension from St. Joseph, Mo., to Rushville, a distance of fourteen and a half miles. Grading on the St. Joseph and Winston extension has been finished and track-laying will be commenced soon.

The Union Pacific Railroad has just let the contracts for the immediate erection of six new iron bridges. The first is on the Kansas Pacific Division, across Wolf Creek, fourteen miles west of Kansas City; one across Green river, Wyoming; one at Laramie, and three over Bitter Creek. The bridge at Dale Creek is to be replaced with a new structure soon. All these bridges are of the very best and most modern pattern.

Rock Island Extensions. ST. JOSEPH, Mo., November 2.—The Chicago, Rock Island and Pacific Railroad Company let the contract to-day for building the Rushville extension of its road. Sheridan Brothers received the contracts for building the first five miles of the road and Mr. J. D. McNeely was awarded the balance—ten miles. The grading is to be completed in four weeks time, and it is the intention of the company to have the line in operation by the 1st of January next. The track on the Winston and St. Joseph extension has been laid as far as Grindstone Creek, eight miles west of Winston junction.

Missouri Pacific Extension.—The contract for building the Nevada, (Mo.) and Minden R. R., thirty miles, has been let to Robert Bagnell, contractor, who has sublet four miles from Nevada to Drywood. Hands are being employed, and work commenced last Monday. Headquarters are at Nevada, Mo.

Prospecting for Coal.—The desire to prospect for coal seems to be contagious in central Illinois Tuscola has a prospect hole 672 feet deep, with a drill fast in it, and is making arrangements to have the work continued with improved devices. Urbana has just raised a bonus, preparatory to prospecting.

Atlantic & Pacific.—It is learned that Jay Gould has secured control of the surveyed line of the Atlantic and Pacific from Red Fork, I. T., to Albuquerque, N. M., a distance of 700 miles, and will soon begin the construction of a road between those two points. This will shorten the route from the East by about 300 miles.

The St. Bernard Railway, a new transalpine line, is likely to be commenced before very long. When completed it will be a dangerous competitor for the through traffic with the already existing route of St. Gothard. One of the principal features of the new road will be an indispensable tunnel of 9½ kilometres in length under the Alps at the Col Ferret. The total length of the St. Bernard line will be only 138 kilomotres.

Thousand Islands.—A bridge will be built this fall connecting Grenell Island, Ontario, with Grenell Park, on the St. Lawrence. Mr. Gardiner, who built the bridge at Thousand Island Park, will have charge of the work. The new bridge will be 200 feet long and 12 feet wide, built on white oak piles, of neat design, and will add much to the convenience of both islands.

The Proposed New Line of railway from Middletown to Hamilton, O., and from Hamilton to Sharon, to be built to enable the Bee Line people to reach Hamilton with their trains, will be commenced as soon as the necessary right of way can be obtained. This will enable Springfield people to visit Hamilton without changing cars at Dayton.

The Lafayette, Newton & Wabash River Railroad Company has reorganized and filed articles of association with the capital stock fixed at $500,000. It is proposed to build a line from Lafayette to a junction with the Lake Michigan & Ohio River Road in Parke County, a distance of fifty miles. The Directors of the company are Adam Blin of Oakley, Alpheus L. Symms, Farmers' Institute, J. G. Henninger of Lafayette, and N. Y. Fisher of Newton, all of Ind.

The St. Paul's Kansas City Line.—CHILLICOTHE, Mo., Oct. 27.—The surveying party which reached here a few days ago from Ottumwa, Iowa, in the interest of the Chicago, Milwaukee & St. Paul Railroad's new line to Kansas City, have returned to a point eighteen miles south of Ottumwa and will locate a line to this city. Field Chief D. H. Ainsworth, with another party, is now engaged locating the route from here to Kansas City. As two lines are to be run it will require some three months to complete the work.

Steel Rails.—PHILADELPHIA, Oct. 29.—The demand for steel rails continues to increase and prices have strengthened $1 per ton since last week, making the ruling price now $32 per ton. The increase in orders for steel rails has been nearly 20,000 tons since last week. The Pennsylvania Railroad Company has given a number of orders, and the prediction is made that prices will steadily increase and reach $35 per ton before the 1st of January. The iron trade has witnessed a falling off in demand, owing, it is stated, to the cheapness with which steel can be made to supplant iron. It is especially noticeable in the falling off in demand for iron rails.

Defenceless Condition of the Coast.—General John Newton, Chief of Engineers, in his annual report invites the attention of Congress to the defenceless condition of the sea-coast and lake frontier, a subject which, he remarks, received careful attention in the last annual report of the Chief of Engineers. He expresses a hope that the beginning of an elaborate system of defence may no longer be delayed for lack of appropriations. The limited amount of funds available during the past year has been mainly applied to placing in serviceable condition the platforms of heavy guns and mortars bearing upon the channels of entrance to the various harbors.

Dispensing With an Engineer.—Sidney, Ill., has lately furnished a good illustration of the folly of saving (?) money by dispensing with the services of an engineer. The citizens make up a purse to prospect for coal; a trial hole was bored with a churn drill, and a 5-foot vein of coal announced at 267 feet. A stock company was formed and a shaft sunk. When the coal was almost reached, a grand opening celebration was announced and full preparations made for a barbecue; but, alas! the coal turned out to be nearly all slate. The company now announce that if coal is found within 500 feet, they will continue the shaft. The citizens are making up a purse to secure some one to sink a trial bore-hole with a diamond drill.

Chicago & West Michigan R. R.—Surveyors in the employ of the Chicago and West Michigan Railroad are running a line from Baldwin to Cadillac.

Connecticut Rivers and Harbors.—The amounts required to complete the improvements of Connecticut rivers and harbors according to the estimates of the war department are: New Haven harbor, $100,000; breakwater at New Haven, $1,091,134; harbor of refuge at Stonington, $53,000; Thames river, $128,000, New London harbor, $6,200; Connecticut river, $257,500; Milford harbor, $6,000; Housatonic river, $30,000; Bridgeport harbor, $45,000; Norwalk harbor, $10,000.

A Mexican Irrigation Scheme.—An important matter is being advanced, the digging of a canal in the Laguna country, that banner district for cotton. The canal proposed is to be sixty miles long some thirty feet wide and from twelve to fifteen feet deep. It is proposed to run it from the San Fernando presa or dam, in order to irrigate the lands of the old "Laguna del Tahualilo." The company formed under the direction of Mr. Hernandez, who guarantees to pay the expense of construction, which will be in the neighborhood of $500,000. The lands to be irrigated are now a desert, but the would-be-concessionaires believe they can transform it into a garden. The proposition is now before the Department of Public Works to send a commission of engineers to open the canal.—*Mexico Two Republics.*—

Central American Railroad.—Proposals will be received by the Secretary of Public Works of the Republic of Salvador (Central America) from January 2nd to January 21, 1886, for the construction of a railroad from the port of La Libertad to the city of San Salvador, the capital of the Republic. The Government will guarantee interest on the capital required for construction, with the condition that at the expiration of ninety-nine years the road shall become the property of the State. In making the award the best proposal will be considered that which includes the following conditions: 1. Conformity to excellence of technical requirements. 2. Interest on a smaller capital and for a shorter time. 3. Lowest rate of interest (the guarantee is not to exceed 8 per cent. yearly). 4. Excellence of guarantee of fulfilment of contract. 5. Requirement of exclusive rights for the shortest period. 6. Completion of work in the shortest time.

Senor Marino Pomares, Consul of Salvador at New York, may be applied to for further information.

Another Accident on the New Aqueduct.—NEW YORK, Oct. 28.—Another accident that will result in the death of at least one man, and probably more, is added to the already long list of disasters that have occurred in the construction of the new aqueduct. One of the main shafts is at Ardsley on the New York and Northern Railroad. Down in the bottom of the tunnel, 300 feet below the surface and about a thousand feet from the shaft, a large portion of the masonry that forms the roof of the tunnel, suddenly gave way yesterday afternoon, and buried beneath it several of the miners who were at work there at the time. As soon as possible the imprisoned men were extricated and sent to Bellevue Hospital. The injured men were John Wilson, aged 23 years, a native of Binghampton, N. Y., comminuted compound fracture of the tibia, said to be very serious; Patrick Breen, aged 25 years, of Eccelsior, Pa., compound fracture of the femur, and a severe fracture of the skull, will probably die before morning; Frank Gorman, of Ardsley, severe contusions of back, and fracture of the left hip, thought to be very dangerous; John Francis, fireman, severely injured.

City and Suburban Railways.—VERMONT.—The Rutland horse railroad is to be built. All but $1,200 of the $28,000 in bonds have been disposed of. The President is negotiating for cars, and 200 tons of steel rails have been ordered.

MASSACHUSETTS.—The Nahant street railway company has been incorporated with a capital of $100,000 for constructing and operating a line of over four miles from the Lynn line to Nahant. Electricity as a motive power may be used.

IOWA.—The equipment for the Waterloo Street Railway has been supplied by Humphreys & Sayce, New York.

Boone, Ia., is to have a street railway and is inquiring for rails. Address A. J. Homes, Boone, Ia.

GEORGIA.—The Classic Street R. Co., of Athens, Ga., have awarded the contract for building their road to James G. Scott.

NEW YORK.—The Metallic Street Railway Supply Company, of Albany, N. Y., has a contract for the construction of the Greenbush Street Railway, from Greenbush to Albany. Messrs. Andrews & Clooney, of New York, contracting to supply the iron work. The system used is Gibbon's patent, exclusively metallic, dispensing with the spikes, bolts, joint-plate and knees now used, as well as timber.

CHICAGO.—The Consolidated Rapid Transit & Elevated Railroad Company of Chicago has been incorporated; capital stock, $12,000,000; incorporators, S. P. Blount, H. C. Todd, J. L. Forch. The purpose is stated to be to construct an elevated railroad from the City of Chicago to Riverdale, South Chicago, Englewood, Washington Heights, Proviso and Norwood Park.

The Denver, Marshall & Boulder R. R. is securing right of way and there is a prospect that the air line will soon be completed.

The Wyandotte, Nebraska and Northwestern Railroad is to run to Beatrice, Neb. The survey has already been made as far as Tonganoxie.

Columbus, O. & Eastern R. R.—The syndicate has proposed to extend the road to Malta, Morgan County, O. Messrs. Stearns, Shaw and Hoover, railroad contractors, are in the syndicate.

Changing Gauge.—The gauge of the Mobile and Ohio road was recently changed to standard in a day. The cost of the work was $28 per mile. The total cost of making the change, including the change of equipment, was about $80,000.

The Bridge Lawsuits.—Inventor Dubois, who long ago brought suit against the Brooklyn bridge for alleged infringement of his caisson patents, has had the action postponed until March. The suits of the National Cable Company on account of the grip are still in the misty future.

St Louis & Kansas City Short Line.—MARSHALL, Mo., Oct. 23.—The surveyors now making a survey of the proposed short-line route between St. Louis and Kansas City, arrived this morning. Captain Miller reports a very satisfactory survey so far. The survey is now being made between this point and Lexington.

Tunnel Leaking.—Water from the canal was leaking into the railroad tunnel at Syracuse, N. Y., last week and caused considerable trouble and alarm as it was feared the wall would give way. Bales of hay and other material were thrown into the canal to stop the break but without effect.

Union Pacific Surveyors.—LANDER, Wy. T., October 22nd.—The corps of Union Pacific surveyors working on the Sweetwater River are rapidly coming up that stream. They are at present near Independence Rock, twenty-five miles from the mouth of the stream. The line will beyond doubt come by Lander.

A New Road for Salina.—SALINA, Kan., October 27th.—Arrangements are fully completed by the Missouri Pacific Railroad Company to complete the line under construction from Council Grove to Salina. Work from the west line of Dickinson county to Salina is to be commenced at once.

Minnesota & Northwestern R. R.—ST. PAUL, Minn., Oct. 28th.—General Superintendent Dupuy says that 95 per cent. of the grading of the Central Iowa extension of his road has been completed and three miles of track laid. There has been some little delay in receiving the rails, but this will not keep the extension from being completed between the 1st and 15th of November.

The Colorado and Kansas Canal and Reservoir Company. has been incorporated. Capital stock $200,000. The operations of the company will be carried on in Bent County, Col., with the principal office in Denver. The incorporators are Festus B. Koen, A. N. Parrish, W. H. Holmes, William M. Bell and W. S. Howland.

Omaha's New Line.—OMAHA, Neb., October 25.—The Railway Committee of the City Board of Trade to-night accepted unanimously an offer from the projectors of the Omaha & Northern to begin building at once from this city in consideration of $150 000 in bonds and a depot site on Jefferson square, in the heart of the city. This transaction is informal and not binding as a contract.

C. B. & Q. Scheme.—The incorporation of the Omaha & North Platte Road, in Nebraska, which is to run from Omaha to Custer County, is attracting no little attention. The enterprise is a Chicago, Burlington & Quincy one. The general manager of the Burlington & Missouri says as soon as the consent of the directors has been obtained, the road will be built, and will undoubtedly prove very profitable.

Consolidated Lines.—FORT SCOTT, KAN., October 26.—The St. Louis, Fort Scott and Wichita and Elsworth, McPherson, Newton and Southeastern roads have been consolidated under the name of the St. Louis, Fort Scott and Wichita. For the present the work of extending the Newton branch will be stopped, which is understood to be in accordance with an understanding between the Gould interests and the Sante Fe.

An English Syndicate has just taken $10,000,000 worth of the stock of the Chicago, Burlington and Northern Railway, after the stock had been guaranteed by the Chicago, Burlington and Quincy road. The syndicate are now building a line from Winona, Minn., to Kansas City, and expect to complete it by the first of January. They will shortly build the El Paso and White Oaks R. R. in Texas.

Yellowstone Park.—The annual report of the Superintendent of the Yellowstone Park states that a large increase in the amount of game in the park has resulted from a better system of watching; that 16 miles of fine roads have been constructed, together with bridges, and that the travel in the park has largely increased. He recommends more adequate laws for the government of the park, and says that $150,000 will be needed for expenses during the next fiscal year.

Chatauqua Lake.—Messrs. Johnson & Co. are pushing the work of construction on the Chatauqua Lake railway.

D. & H. C. Co.—A new freight track from Mechanicville to Stillwater, a distance of three miles, will soon be laid by the Delaware and Hudson Canal Company.

An Illinois Road Commenced.—Ground has been broken on the new Aurora & Joliet Railroad, a large force of men commencing grading on the new line east of Plainfield. The contractors expect to have the road graded as far as Joliet and the rails laid before Christmas.

Local Improvements Stopped.—MONTREAL, Oct. 29.—The Chairman of the Civic Finance Committee announced to-day that local improvements would have to be stopped as the city had already run in debt over $500,000, caused by the extra expenditure through the smallpox.

Maricopa & Phœnix R. R.—Surveys have been completed for the Maricopa and Phœnix Railroad, Cal., and as soon as negotiations are concluded for constructing the line through the Piama Reservation grading will be commenced. Under the present survey the road will connect with the Southern Pacific at a point six miles east from Maricopa. The line to Phœnix will be thirty-five miles in length and for the most part straight and level. It is expected that the road will be finished and cars running before the end of February next.

Sale of the Great Eastern.—The Great Eastern, the largest steamship in the world, has been sold at public auction at London for £26,200. Her construction commenced on May 1, 1854, and the work of launching her, which lasted from November 3, 1857, to January 31, 1858, cost £60,000, hydraulic pressure being employed. Her extreme length is 680 feet; breadth, 82½ feet and, including paddle-boxes, 118 feet; height 58 feet, or 70 feet to the top of bulwarks. She has eight engines capable in actual work of 11,000 horse power, and has, besides, twenty auxiliary engines. She was sold 1864 for £25,000, and was employed on several occasions with success as a cable-laying vessel.

Growth of City Travel.—In 1850, with a population of 515,547 and only two railways, there were 6,835,548 passengers carried by street railways in New York. In 1875, when the population reached 1,045,223 and with nineteen railways, the number of passengers grew to 166,918,173. In 1880, when the census showed a population of 1,206,299, and with twenty-three railways, including the elevated, 211,222,348 persons were carried, while in 1884, with the same number of railways, 284,115,862 passengers were carried, an increase of 120,179,564, of which the "L" roads carried 96,702,620, and the five principal horse-car lines 103,978,554.

The Ordnance Commission.—The members of the board appointed by Congress to inspect different steel and iron works in the country to ascertain their capacity for making ordnance, visited the Pennsylvania Steel Works at Steelton, Pa., October 27th; and on the 28th, inspected the Midvale Steel Works, Philadelphia. On the 30th they visited the West Point, (N. Y.) foundry, and while there the operation of shrinking steel sleeves on the gun tubes for the navy was performed, also the insertion of an 8-inch gun tube into a 10-inch Rodman gun for the United States Ordnance. It is understood that they are about evenly divided on the subject of a recommendation of iron or steel for heavy ordnance, as their instructions do not particularly designate either one as the metal to be chosen.

A New Ship Canal.—A group of French and Russian capitalists are seeking from the Russian Minister of finance a concession for cutting a canal between the rivers Volga and Don. These two mighty streams penetrate in their course through Russia within fifty miles of each other at Tsaritzin, and then strike off, one to the Black Sea and the other to the Caspian. The promoters of the undertaking seek, by the construction of the canal, to give the extensive commerce of the Volga an outlet into the Black Sea. The physical difficulties are not insuperable, although sufficiently severe to test the resources of any except a very powerful syndicate. The idea of the canal is by no means new. Peter the Great having personally gone over the ground and made a rough scheme for one. His successors, however, in spite of their enterprise in canal-making, have always been averse to the undertaking. In the flood season both rivers are unmanageable, and it has been thought that if a canal were cut, the Volga might, some spring, burst into the Don and cause a catastrophe. Of course, with engineering skill, it would be easy to prevent this fear of timid ministers being realized, but it is interesting to mention that nature herself is preparing the way for some such eventuality, the Volga yearly cutting more and more into its west bank, and thereby drawing nearer the Don. At present the two rivers are connected by a railway, described by Mackenzie Wallace as the slowest, worst laid, and most infamous in Europe. The traffic is not very large, and even the promoters of the canal project do not think they could carry out their project without a considerable subsidy from the State.

The Last Spike, on the Canadian Pacific Railway was driven on the 5th without ceremony.

The Bolan Pass Railway whose completion is so eagerly desired by advocates of improved frontier defence in India, passes through a terribly hot region. A Persian saying pitifully describes the Lower Bolan thus: "Seeing that there is Dadur, why did Allah make the infernal regions?" The railway up the pass is a broad line laid practically in the bed of the river. Probably considerable lengths would be submerged in a heavy flood though the line has been laid, when practicable, on timber piers, and the engineers hope that the floods would pass harmlessly over these bridges. The line winds through the gorges like a snake, the smallest curve being 890 feet radius, and the steepest gradient is 150.

The Omaha Railroad Bridge.—The new Union Pacific bridge at Omaha will be about 1,000 feet shorter than the present structure. It is thought that the river channel has narrowed and deepened sufficient to make a fill on the east side perfectly safe and secure. It might be interesting to know that the present bridge when first constructed was 2,750 feet long, but a frisky cyclone came that way some years ago and swept 250 feet off of the Council Bluffs end. The 250 feet was filled in with dirt, leaving the structure 2,500 feet long. Twenty carloads of red fir timber with which to build caissons for the new bridge have arrived at Omaha.

North Pacific Coast Railway.—The extension of the line from Duncan's Mills, Cal., northward, is going forward rapidly, about 1,000 men being employed at present. The road has been surveyed up Austin Creek to Ingram's, beyond which point no survey has yet been made, the projectors being in doubt as to which route will be the most feasible. About three and one-half of grading have been done beyond Duncan's Mills, and work will soon be commenced on two or three bridges across Austin Creek. Some track-laying has already been done. As the grades are not very heavy, it is expected to finish the line to Ingram's before the end of the year. It is the intention of the company to eventually extend the line up the coast to Oregon.

Minnesota Works in Congress.—The Mississippi Water Power and Boom Company of Brainerd asks permission to construct across the river, at some point near Brainerd, a dam, canal, and the appurtenances thereof, for water power and other purposes, and in connection therewith a wagon and footbridge for public travel. The St. Paul, Minneapolis & Minnetonka Railway company want to Construct a bridge at some point between Fort Snelling and the Falls of St. Anthony, and as there is a strong probability that the navigation may ultimately be improved so as to permit the passage of large boats through this stretch of river, it is proper that the bridge, if built with one continuous span, shall be at least 60 feet above extreme high water mark. Anoka City desires to construct a highway bridge across the river. The Minneapolis, Sault Saint Marie & Atlantic Railway wants to bridge the St. Croix river at the most accessible point between Stillwater and Taylor's Falls.

Chicago, Freeport & St. Paul R. R.—Up to the present time five distinct surveys have been made from Chicago to the Wisconsin river; which of these routes will be chosen as the permanent one is not yet decided. One of the above lines is thirty-five miles shorter than any route at present between St. Paul and Chicago, and its heaviest grade is eighty feet, with numerous other fifty-three feet grades. Either of the above surveys will permit the building of the road at a cheaper cost than any now running between the two cities mentioned and will be of a lesser grade. From the Wisconsin river to St. Paul there have been six surveys made, but none will be definitely located until the survey by way of Stillwater is made, which will doubtless not be until next spring. No roads have yet been laid, and nothing done in that direction except a few miles of grading from Chicago out. Next spring will see a large force of workmen employed laying rails. It is the intention to finish the road from Chicago to Minneapolis in two seasons.

How B. & O. Will Enter New York.—It is rumored in certain quarters that the Baltimore & Ohio people have no idea whatever of either coming to New York over the New Jersey Central, nor by the Pennsylvania Railroad. As we understand it, their scheme is to build from Philadelphia to the Kill Von Kull, and cross over to Staten Island, where the most magnificant terminals can be had for a tenth of the price of those in Jersey City. Hereshoff, the builder of the Stilleto, is to be given contracts for the construction of several fast steamers, which will convey passengers from Staten Island to the Battery in fifteen minutes. The route by Staten Island will be much shorter than by existing lines, and cannot fail to prove extremely attractive to the traveling public. An immense coal distributing depot will be established on Staten Island as well as elevators and storage warehouses. As the Baltimore & Ohio has a surplus of nearly $50,000,000, the cost of the extension will be easily taken care of. With the facilities which the elevated railroads afford at the Battery for delivering passengers to all points of New York, the new line will be able to command a large share of travel.—*Wall Street News.*

Work will be resumed at Roach's ship yards on Monday.

New York City.—Estimates for repairing piers at Little West 12th and West 17th street, North River, will be received by the Docks Department till November 16th.

Panama Canal.—An American company, the Franco-American Trading Company, has just closed an arrangement with Messrs. McKechney & Callahan, practical railroad builders, to carry on the work of 6,000,000 to 8,000,000 cubic metres of excavation on the Pacific side of the canal. The contractors are to use American and French dredges and to commence operations at once.

The Lachine Bridge.—MONTREAL, Nov. 5.—The tenders for the construction of the Canadian Pacific Railway bridge at Lachine were opened to-day. These include tenders from the Union Bridge Company, of New York, represented by Mr. T. C. Clark; the Phœnixville Bridge Company, the Bridge Co., of Edgemoor, Del; the Keystone Bridge Company of Pittsburg, Penn.; and the Dominion Bridge Company, of Lachine. The lowest bid is within the estimate made by the engineer-in-chief, Mr. P. A. Peterson, which, including the four miles of approaches, and all other work, footed up $1,250,000. The contractors who are to be awarded the stone work, Messrs. Reid & Fleming, who built the International Bridge at Buffalo, are already looking out for quarries, and the entire work will be under way very shortly, as it must be completed by Nov. 30, 1886. The contract for the iron work has not yet been made public.

Strong King Bridge.—NEWBURGH, Nov. 5.—Maps were filed in the Orange County clerk's office in Goshen yesterday, by the New England and Southwestern Railroad Company, signed by Chauncey Vibbard, President, and William V. Smith, chief engineer, covering their line of road from a junction with the Erie Railroad's Greycourt Branch, crossing the Hudson River at Storm King Mountain, and making connection with the New York and New England and Harlem roads at Brewster, New York.

This link gives a direct short all rail route from the coal fields of Pennsylvania, and the cotton fields of the South to the New England States, and will shorten the route from Memphis to the New England States over 200 miles, and will give the Erie Road a haul on its entire line on eastern traffic, instead of delivering its eastern traffic to other roads at Binghamton. The bridge over the Hudson will be 225 feet high. It is estimated that this connection will give the Harlem road 2,000,000 tons of coal to haul for the city of New York and the north. Work will be begun at an early day.

A dispatch from Taunton, Mass., says that the contract for the bridge over the Hudson has been awarded to the Phœnix Bridge Company.—*N. Y. Tribune.*

The Leavenworth, Northern and Southern Railroad Company, was organized on the 30th. ult., with Len T. Smith of Leavenworth as President, W. S. Reyburn of Philadelphia as Vice-president, and Samuel E. Havens of Leavenworth, Secretary. A charter has been obtained and a proposition formulated to submit to the voters of Leavenworth County for $60,000 to assist in building the road through the county. The charter names the northern terminus of the road in Nemaha County and the southwestern terminus in Comanche County, Kansas. The capital stock is $10,000,000 divided into 100,000 shares. Besides the officers named the Board of Directors includes Alexander Caldwell, E. P. Wilson, M. H. Insley, Paul Evans and E. Stillings—well-known Kansas capitalists supposed to be in interest of C.B.& Q.

South Penn. Railroad.—BURNT CABINS, Pa., Oct. 28.—Three months ago Burnt Cabins, Fort Littleton and Everett were the scene of tremendous business activity through the work on the South Penn road; to-day everything is as dull as a door-nail, and the native population have again quietly assumed their agricultural pursuits, speaking only in terms of disgust of the bad manner in which they were used by the capitalists and monopolists. The work done in this section of the South Penn exceeded that of any other portion of the road, and millions of dollars were expended, most of which went to the foreign element, consisting of Hungarians, Italians, Swedes, Germans and Irish, of which there were about 15,000. There were also 1000 or more colored men. The work on the tunnels was the most expensive and troublesome. There is not a railroad in the country that had to contend, with such mountains as the South Penn in a distance of twenty-five miles. The engineers were ordered to lay out a direct line from Harrisburg to Pittsburg, and in order to do this had to cut through the mountains nine times in the counties of Franklin, Fulton, and Bedford. The Blue Mountain tunnel has been driven 1,890 feet in the east and 1,190 in the west, with 1,160 to finish: Kittaning tunnel 2,382 feet in the east, 1,861 in the west 557 feet to a finish: Tuscarora tunnel 1,913 feet in the east, 1,780 in the west, 1,700 to a finish; Sideling Hill tunnel, 1,972 in the east, 1,571 in the west, 3,091 to a finish; Ray's Hill tunnel 1,390 feet in the eas, 1,140 in the west, 1,370 to a finish: Allegheny tunnel 2,033 feet in the east, 1,913 in the west, 1,654 to a finish; Laurel Hill tunnel 396 feet in the east, 890 in the west, 4,900 feet to a finish; Negro Mountain and Quemahoning tunnels are each about 1,100 feet in length and half finished.—*Exchange.*

Among the Industries.

The steel rail makers are congratulating themselves over the success of their policy in restricting production. Manufacturers in some lines of production, are asking each other why that policy cannot be partially employed to improve demand and prices. Trade and industrial combination will no doubt be attempted during the coming winter on a scale of greater or less magnitude, according as circumstances and prospects seem to warrant. The last three months brought a large amount of business, and at the present time nearly all of the industries have more orders for future execution and delivery than they have had for perhaps a year and a half. It is natural therefore, that a great deal of interest should be felt in the spring trade, and that manufacturers and traders should be more disposed for each class to act together to better themselves. It is safe to say that prices have reached their lowest probable limit. It is also safe to say that an improving tendency is in progress, and that combinations have greater chances of success now than they have had. A little improvement in prices would be of general advantage in proving that the limit of extreme depression had been reached, and that consumption was once more in excess of supply. The transactions of the past two or three weeks in all leading industries show that a very moderate restoration of confidence has been effected, and that an upward tendency in prices is probable, and that no reaction is likely to arrest the improving tendency at work. Manufacturers have orders on hand of considerable magnitude. Legitimate consumption is also increasing. Scores of small industries are springing up and scores of others are expanding in productive capacity. Manufacturers are carrying larger stocks and contracting for more remote points in the future than they felt it safe to contract for for many months. All these are favorable indices of what is to come. It is not probable that many manufacturing branches will be able to do what the steel rail makers have done, but it is certain that they will take advantage of every opportunity that presents itself. There will be less cutting hereafter, less overproduction and less tendency to overproduce. Business will be conducted on a legitimate basis and with more conservatism. Those who are anxious to get business at any price, will be permitted to do so. A higher standard of trade morality is gradually building itself up. The future requirements of the country are more fully understood than they have been for ten years. The danger of a boom of any kind is more remote than ever. Despite the great abundance of capital, and the temptation of low prices of material, railway building has not been attempted beyond the country's actual requirements.

During the past thirty days a large number of new enterprises have been brought to the public attention. The sale of securities has increased. Bonds are in better demand, and for many lines better prices are paid than thirty days ago. The confidence of European investors in our securities is growing, and this is a very important factor. The probabilities of next year's construction cannot be guessed at very safely as yet, but this much can be said, that it will exceed this year's limit. The restricted opportunities for the employment of capital, have led to the diversion of large sums into more legitimate fields of enterprise, such as purchases of lumber and mineral lands, and in the building and projected building of short lines of road, ranging from five to fifty miles to develop these territories. In West Virginia, Pennsylvania, Michigan, Wisconsin, Tennessee, Alabama, and some sections beyond the Mississippi, the spirit of enterprise has taken hold of the resources of this section, and work is being prosecuted which will very largely develop the supply of lumber and coal particularly, to say nothing of land valuable for agricultural purposes.

The owners of these land and roads are in many cases developing their properties for themselves, and are erecting saw and planing mills, and putting up mining machinery, and are leasing their property either in improved or unimproved condition, and in this way are attracting a very industrious immigration into these new fields, which any time will help to create new local markets.

The demand for locomotives and cars has not absorbed very much over 50 per cent. of the total capacity of the country. The demand for bridge iron has been heavy, and at the present time the entire capacity of the country is moderately engaged in filling contracts calling for completion by December 1st to 15th. The wrought pipe mills are crowded with orders, and the supply of skelp iron is far behind. The nails makers throughout the East are unable to meet the enormous pressure for supplies, and in the West there is an absolute stringency in the market which is creating much inconvenience among builders and others. The bar mills throughout New York, Pennsylvania and Ohio have been busy for two months, but within two weeks orders have slackened up, though prices still continue firm. In sheet mills there is a rush of orders, large and small, for delivery during this and next month, and in the plate mills orders are sufficient to keep the entire capacity at work at prices ranging from 2 to 3 cents per pound. The merchant steel mills are well employed, and, in many cases, have orders for delivery three months ahead. Prices are extremely low in all branches, except steel rails, nails and wrought pipe, where exceptional conditions are at work to strengthen prices and expand demand.

The lumber interests are complaining of low prices from Boston to Chicago. The consumption has been heavier this year than last, and every indication points to a winter of fair activity and somewhat higher prices on account of the advance in freight rates. The manufacturers of textile machinery are busier than they have been for twelve months, and orders for the newest and best makes of looms and other machinery are coming in moderately. The makers of boilers and engines throughout the New England States have no complaints to make as to business, and in the middle States, the work in hand is such as to allow a slight improvement in prices. The manufacturing, railroad and domestic consumption of coal has expanded very rapidly within the past thirty days, owing to the fact that consumers failed to place orders early in the season. The capacity of the Anthracite mines is taxed to fill orders for New England and Western markets, and prices have advanced from 10 to 25 cents per ton. There is less activity in the bituminous coal sections, but in all Eastern and Western markets an increase in deliveries is observed. In many of the smaller industries reports are quite gratifying, and in none is there any actual cause for complaint, except in the one respect of narrow margins. This evil will be remedied in time. Any sudden or rapid advance is undesirable as tending to unduly stimulate production and mislead manufacturing interests. The volume of money is large and the rate of interest is low. Failures are comparatively few, and where they are occurring it is due to over trading rather than decreasing consumption. The country is expanding in its purchasing and consuming power every day, and this fact offers sufficient encouragement to legitimate industry to hang on and crowd through every seeming obstacle which bitter competition is constantly throwing in the way.

PHILADELPHIA, November 1.—A somewhat general movement, on the part of users of iron and steel developed itself this week in New York, Pennsylvania and lake markets. Sales of over 100,000 tons of rails were made at $30 to $38. Bridge, plate, bar and wrought pipe iron were ordered liberally. Nails continue scarce, and, unless the West resume, a further advance is likely to result. Merchant steel, for machine shop, tool shop, railroad shop and implement use will not advance, no matter how active the demand.

Market Report of Engineering Materials.

New York, November 6, 1885.

NOTE.—The following Market Report gives wholesale prices on the New York Market unless otherwise stated. It is intended as a general guide to the estimating engineer, and both the range of material and the market location will be extended as rapidly as possible. We give it with this caution, that, as is well understood in business transactions, the amount of bill, distance from market centre and conditions of payment will have a material influence on the final paying prices.

IRON.

STRUCTURAL IRON.			
Angles	1.95	@	2.05
Tee	2.2	@	2.4c.
Beams and channels American	3.0c.	@	
Tank	2.	@	2.1c
Shell	2.4c.	@	2.5c
Steel plates, Tank	2¾c.	@	3c.
WROUGHT-IRON PIPE. PITTSBURGH.			
Butt welded, black ... Discount	42½	@	45
" " galvanized ... "	32½	@	35
Lap welded black ... "	60	@	62½
" " Galvanized ... "	45	@	42½
Boiler tubes ... "	57½		
RAILS.			
Steel (large lots at mill)	30.00	@	31.00
Old rails	17.25	@	17.50
Old rail steel	17.00	@	18.00
R R. spikes	1.8	@	1.9
R R. splice-plates	1.65	@	1.7.
R R. Track Bolts Square Nuts	2.55	@	2.65
Barb-wire fencing, galvanized			4.50
" " painted			3.50
Corrugated iron			
Nails			
Iron, per keg	3.25		
Steel do.	3.35		

METALS.

COPPER.			
Lake Superior	11	@	11¼
Other Brands	10	@	10¾
LEAD.			
Com. Domestic	4.15		
Lead Pipe	.05¾		
Tin-Lined Lead Pipe	.15		
Sheet Lead	.06¾		
ZINC.			
Sheet	5.75	@	6.00

BRICK.

(Cargoes afloat)			
Haverstraw ... per M.	$5.75	@	6.12½
Fishkill			
Up-River	5.50	@	6.00
Jerseys	4.75	@	5.75
Long Island			
" pale	3.00	@	3.50
FRONTS.			
Croton red	11.00	@	14.00
" dark	11.00	@	14.00
" brown	10.00	@	13.00
Philadelphia pressed	24.00	@	25.00
Trenton "	24.00	@	25.00
Baltimore "	37.00	@	41.00
Buff "	33.00	@	35.00
Enameled English	65.00	@	130.00
" American	85.00	@	120.00
Fire brick	25.00	@	40.00

CEMENT.

The following price current is made up entirely from quotations furnished us directly by the firms dealing in each brand; the prices are understood to be wholesale in New York, subject to such special rates as large quantities may warrant:

BAETJER & MEYERSTEIN:			
Hanover Port and	$2.60	@	$2.65
BELLONI & Co.:			
Hemmoor "Crown" brand			2.50
JAMES BRAND:			
K. B. & S.	2.55	@	3.00
BROOKS, SHOOBRIDGE & Co.	2.55	@	2.60
HOWARD FLEMING:			
Gibbs' English Portland, 400 lbs.	2.65	@	2.90
K. B. & S. " "	2.75	@	2.95
Stettiner, German	2.65	@	2.85
Lagerdorfer, "	2.45	@	2.75
Fieve, A 1, Belgian	2.35	@	2.50
Roman	2.75	@	3.00
Keene's Coarse	4.75	@	5.50
" Fine	7.75	@	8.50
" Superfine	8.50	@	10.00
GABRIEL & SCHALL:			
Vorwohler "Lion"	2.65	@	3.10
HUDSON RIVER CEMENT CO. Rosendale			1.10
JOHNSON & WILSON:			
Saylor's American Portland	2.15	@	2.40
LAWRENCE CEMENT CO.:			
Hoffman Rosendale			
LESLEY & TRINKLE, Philadelphia, Pa.:			
"Giant" Portland	2.20	@	2.40
Improved "Union"	1.25	@	1.50
Union	1.10	@	1.20
MARCIAL & Co.:			
J. B. White & Bros. Coarse	4.50	@	5.00
" " Fine	8.00	@	10.00
" " Portland	2.45	@	2.85
NEW YORK CEMENT CO.:			
Rosendale			1.20
N. Y. & ROSENDALE CEMENT CO.:			
Rosendale, "Bridge" brand			1.00
SINCLAIR & BABSON:			
Alsen's Portland	2.45	@	2.75
STANDARD CEMENT CO.			
E. THIELE:			
Dyckerhoff	2.90	@	3.25
UNITED STATES CEMENT CO.:			
Windsor	1.00	@	1.10
Standard			1.15
Cable's Portland	2.15	@	2.40
UNION AKRON CEMENT CO.:			
Akron "Star" brand			

ASPHALT.

Prices range per ton ... According to quantity or brand, and whether taken from vessel or store.	$15.00	@	20.00

LIME.

Rockland common per bbl	1.00		
" finishing	1.20		
State, common	.90		
" finishing	1.10		
Kingston, ground	0.95		
Add 25c. to above figures for yard rates.			

STONE.

Cargo rates at New York.

Amherst freestone, No. 1 per cub. ft.	0.90	@	95
" " No. 2 "	0.75	@	0.80
" " light drab "	0.80	@	0.95
Berlin " in rough "	0.75	@	1.00
Berea " " "	0.75	@	1.00
Brownstone, Portland, Ct. "	1.00	@	1.30
" Belleville, N. J. "	0.75	@	1.25
Granite, rough	0.60	@	1.25
Common building stone per load	2.00	@	3.00
Base stone, from 2½ to 6 ft. lengths, per lin. ft.	0.40	@	3.00

SLATE.

Purple roofing per square	6.00	@	7.00
Green "	6.00	@	7.00
Red "	15.00		
Black Penna. (at New York) "	4.50	@	5.00

LUMBER.

Prices for yard delivery in New York.

PINE, Common box per M.	18.00	@	20.0
" Choice "	55.00	@	80.
Tally plank, 1¼ in. 10 in. dres'd. each.	.44	@	.50
Tally boards, dressed com. "	.28	@	.30
SPRUCE, Boards dressed "	.25	@	.28
Plank, 1¼ in "	.28	@	.30
" 2 in. "	.38	@	.40
" 2 in. dressed "	.43	@	.45
Timber per M.	20.00	@	22.00
HEMLOCK, Boards each.	.18	@	.20
Joist, 2¼ × 4 to 4 × 6 in.	.17	@	.44
OAK per M.	55.00	@	65.00
CYPRESS 1, 1¼, 2 and 2¼ in "	35.00	@	40.00
YELLOW PINE, Girders "	25.00	@	30.00
Dressed flooring "	28.00	@	35.00
SHINGLES, Extra shaved pine, 16 in. "			
" sawed 18 in. "	5.75	@	6.00
LATH, Cargo rate "	2.10	@	2.25

PAINT.

Lead, white, American dry per lb	.04¾	@	.05
" " in oil pure "	.05¼	@	.05¾
English, B. B. in oil	.08½	@	.08¾
Red, American	.05½	@	.05¾
Litharge "	.05	@	.05¼
Venetian red, American "	.01	@	.01¼
Indian red "	.05	@	.10
Vermillion, American lead "	.11	@	.11½
Paris green "	.15	@	.19
Umber, Amer. raw and powdered per lb.	.01¼	@	.01½
Drop black, Amer. "	.08	@	.12
" " " "	.09	@	.11¾
Chrome green "	.05	@	.15
Oxide zinc, American "	.03¾	@	.04
" French "	.06¼	@	.06¾